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Screw Cutting Foot Lathe.

The engraving shows a new design of foot lathe brought out by W. C. Young and Co., of Worcester, Mass.

The lathe is of 9-inch swing and takes in 24 inches between centers. The live spindle has a $\frac{3}{8}$ inch hole through it, and the taper of the centers corresponds to the Morse Taper No. 1, making it convenient to use twist drills, chucks, or other tools having standard taper shanks. The cone-pulley has three steps, providing, with the back-gear, for six changes of speed.

The motion of the lead screw is reversible by a lever to provide for cutting right and left hand screws.

The lathe has a compound rest, center rest, hand rest with long and short T's, a full set of change gears for screw cutting, and all necessary wrenches.

The compound rest can be set at any angle and can be moved to and from the centers to any desired position.

The tail stock has a set-over, for turning tapers, and is secured to the bed by a cam and lever of improved design. The height of the tool is adjusted by means of a screw, so arranged as to secure a satisfactory adjustment.

The spindle, lead screw, rack, studs, and all the smaller gears are made of the best machinery steel, the rack and gears being cut by the Brown and Sharpe Manufacturing Co's patent cutters. The hand rest attachment can be substituted for the compound rest by removing one nut.

The foot motion is of a new and improved design, the treadle being adjustable to any desired position, and the crank so arranged as to be automatically disconnected in case any obstruction is placed under the treadle.

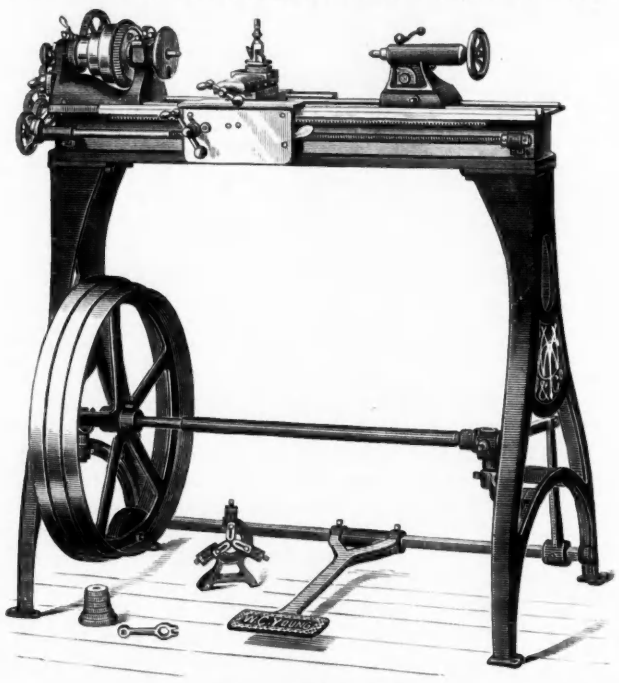
The makers state that it has been the object in designing this lathe to furnish a complete tool, capable of doing a large variety of work without the necessity for purchasing extras.

Peter A. Frasse & Co. are the agents in New York.

A recent article in a contemporary illustrates the mistakes of some who attempt to enlighten practical engineers in the mysteries of steam and steam making. Having, apparently, read somewhere that a good steam engine utilized no more than one-tenth of the heat possibility of the fuel, this writer jumps to the conclusion that the loss is all in and about the boiler, and gravely argues that there is nothing remarkable in a loss of ninety per cent. of efficiency there. Seventy per cent. efficiency in a boiler is not uncommon, while as low as 50 per cent., except in exceptional cases, would represent very poor practice.

We published recently a San Francisco dispatch to the effect that Mr. Babcock, the inventor of the fire-extinguishing apparatus which has taken his name, died in that city in reduced circumstances. A Brooklyn correspondent sends us a clipping which he says he took from a San Francisco paper, and which states that the Mr. Babcock who died there was another man, and that the inventor of the fire extinguisher is now alive and in excellent financial circumstances. We trust this is true.

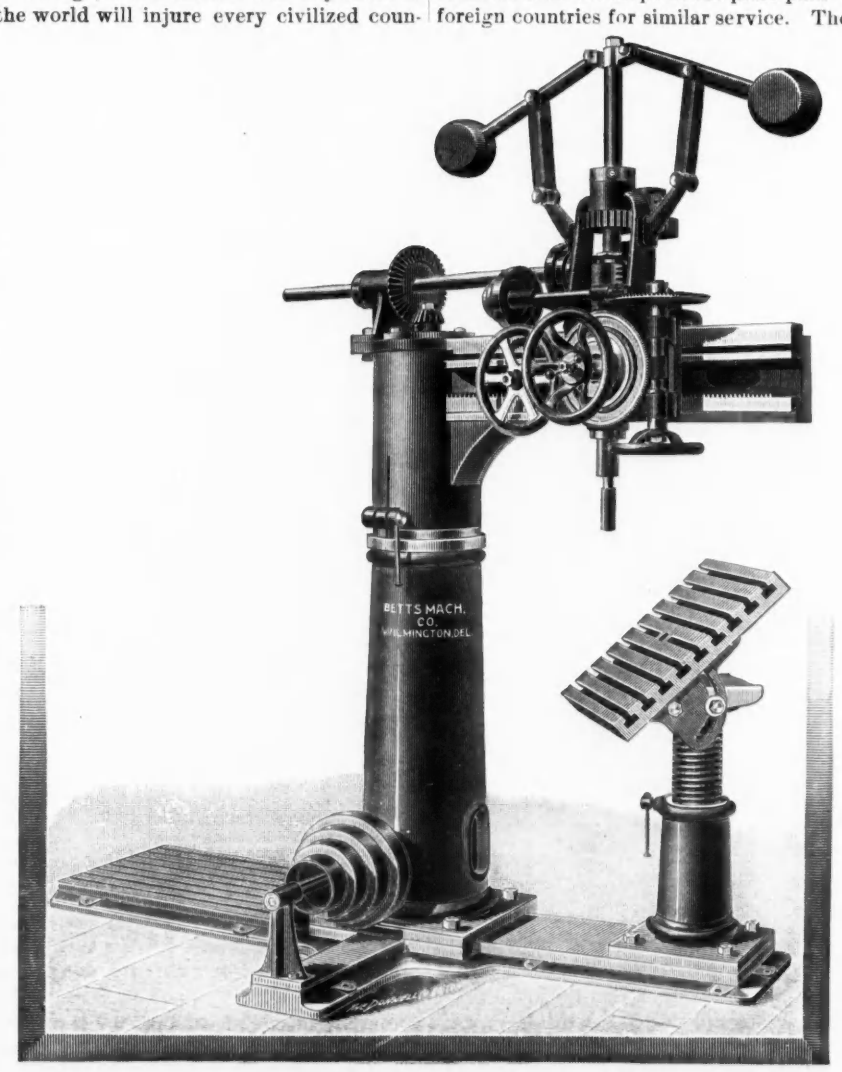
The argument is put forth that war in Europe would benefit this country, in that it would create a demand for material and



SCREW CUTTING FOOT LATHE.

breadstuffs. There might be a temporary advantage, but in the end war anywhere in the world will injure every civilized country. The petition for universal peace is not only in the interest of humanity, but in the interest of prosperity as well.

There are more things than one to be considered in the establishment of American ocean steamship lines. One of them is that competent Americans will never be found to man the ships at the price paid in foreign countries for similar service. Then it becomes a question, what would be the advantage of American steamships officered and manned by cheap foreign labor?



BALANCED SPINDLE RADIAL DRILL.

Balanced Spindle Radial Drill.

The advantages of a radial over any other type of drill are too well known to need any explanation here, and the superiority of a balanced spindle drill is also manifest, though probably not so familiar. The particular advantages of the drill here represented consist of the peculiar method of balancing the spindle with a double weight, thus equalizing the strain and preventing side thrust on the spindle, the quick return and automatic feed, and the rapid movement to spindle carriage, through a rack, instead of the usual method by means of a screw. This feature has its peculiar advantages, among which may be mentioned the fact that it enables the spindle carriage to be moved along the arm with the facility attending the movement of a lathe carriage, and this movement is effected by means of a hand wheel which is on the carriage, and so always in a convenient position, close to where the work is being done, and where the workman must stand, thus avoiding the necessity for going to the end of the arm for that purpose.

The hand wheels and clutches for the different movements are conveniently placed for the workman, and it has a locking device to secure the carriage to arm in any position. The adjoining cut represents the drill with a 48-inch radius, and having sufficient movement toward the column to cover a great range of work. It is arranged with a square hinged table, which is practically universal in all its movements, and has a convenient clamping device to hold it rigidly in any position. If desired, other forms of tables can be used. The machine, as a whole, is calculated for doing a variety of work with accuracy, convenience, and rapidity. The makers are the Betts Machine Co., of Wilmington, Del.

In a shop in Cincinnati we noticed recently posted up over a desk the following notice:

"TO EMPLOYES:

"All papers and books on this bench are for your benefit and information. By reading them you will find what our co-laborers in other parts of the mechanical world are doing with their brain power, after the whistle blows, to elevate themselves in the social sphere, and to simplify the old laws of mechanics.

"Take them home and see if they will make you wiser."

We were informed that the proprietors received every week a number of mechanical and technical publications, which, after looking over, they placed upon this desk, for the benefit of those who cared to take them home.

There can be no question as to the benefit, both to mechanics and their employers, of the cultivation of a taste for mechanical and scientific reading and study, and this is one way of doing so. We think, however, that every mechanic should take and pay for at least one mechanical paper, and should preserve the numbers for future reference, and as a record of mechanical progress in his line. And on this point we may say that the same firm reserves one mechanical journal, which modesty forbids our naming, and has the numbers bound for use as reference volumes by draftsmen and others who may have occasion to use them.

Practical Details of Blacksmithing.

By B. F. Spalding.

PIPE HOOKS, CHROME STEEL, FORKED FORGINGS.

In 1870 a mechanic in the city of New York had his attention directed to the staple hooks used by steam and gas fitters in putting up small pipe. They are used also by plumbers. As these hooks had the appearance of being made by hand, he devised a plan to make them by machinery, something after the style of nail machinery. He prepared some sketches of the tools which suggested themselves to him, and the plans, as I remember them, were something after the fashion shown in Figs. 1 and 2.

It will be readily perceived by the sketch, that by taking stock of the proper width, with punching or shearing dies of the right shape, he could cut out two blanks at every stroke; as when he cut out the piece *B*, the piece *A*, of the same shape, was also detached, and the piece *C* was angled, so that when the next piece *D* was cut out, then *C* would be detached, as *A* was when *B* was cut out; the direct products, *B* and *D*, being like and equal to the indirect products, *A* and *C*. He had also a very simple machine for bending and half-ovaling the hook, at a fair speed, and projected a self-feeder for performing this operation at a more rapid rate, if it should be found to be profitable to make them in great numbers. He submitted his plans to a large wholesale house, which made the usual claim to having its own manufactory, and was encouraged with the result of their deliberations, which was, that they would sell all he would make.

The line of least resistance trended in another direction. I believe he caught on to the electrical business, which commenced to boom about this time, and did not prosecute his scheme any further.

Among other things which he saw about this time, was some chrome steel which would harden well, and would not become magnetic; qualities which are valuable in drills anywhere, and in the springs of watches which are to be carried in the vicinity of electrical machines.

I visited an establishment some time ago where were manufactured a great many forked forgings, something in the shape of Fig. 3.

They were round, shank and prongs. The shank was 4″ long, ¾″ diameter at the butt, and ⅝″ diameter at the neck. The fork or prongs, were ½″ diameter and 2⅞″ long from the throat to a line drawn across the ends. The plan in use for making them was to take a piece of 1¼″ × ½″ refined iron, which had been cut under the shears to 5½″ long, and, holding it in a pair of gauge tongs, draw about 2 7/16″ of it under the trip-hammer, with a pair of suitable dies to form the shank. It then went to the blacksmith, whose business it was to make the fork. This manufacture had been carried on for years, and at one time and another there were quite a number of different men who performed this operation. After working two or three days at it, and trying different plans, they would each settle down to steady work on the plan which gave him the best results. There would be little kinks which each would have for himself, but the general plan was to take a fair heat in the first place, and weld up the iron at the root of the fork, and laying it flat on the anvil, split back with the chisel for about 2½ inches, and knock it a little open. The blacksmith then laid it in the fire, took a good, soft, welding heat on it, and seizing it by the side of the shank, drew out first one and then the other of the prongs, with his helper, turning it to keep it square, thus welding it soundly, and then, at the same heat he knocked down the corners, and rounded the prongs up in a pair of swaging tools. The lower swage was of the proper length to form a gauge, to which each end was cut with a chisel. The men, with some practice, would make a hundred of these in a day, throwing them down at a red heat in the shape of a block letter **Y**. The next operation was to bend them into a fork shape. For this purpose a pair of tongs were used as shown in Fig. 4 or in Fig. 7.

The fork was reheated by the helper, and the blacksmith seized the shank between the jaws of the tongs *A A*, and bent the prongs over the "former" *B*, which was solid with one of the jaws. As there was very little difference in the size of the shanks, there was little trouble in getting the prongs bent central and in line with the shank. If there had been one with a shank ⅛″ larger than the size, its center would have been carried 1/16″ away from the fixed jaw, and the prong on that side would have been ⅛″ too long. Bending forks on these heavy tongs was laborious work. The whole business of making them by hand was too much like hard work for this age of steam. If machinery driven by inanimate forces is of any real value, it is when it supplies the place of exhausting human toil. After some deliberation it was resolved to make these forks by machinery.

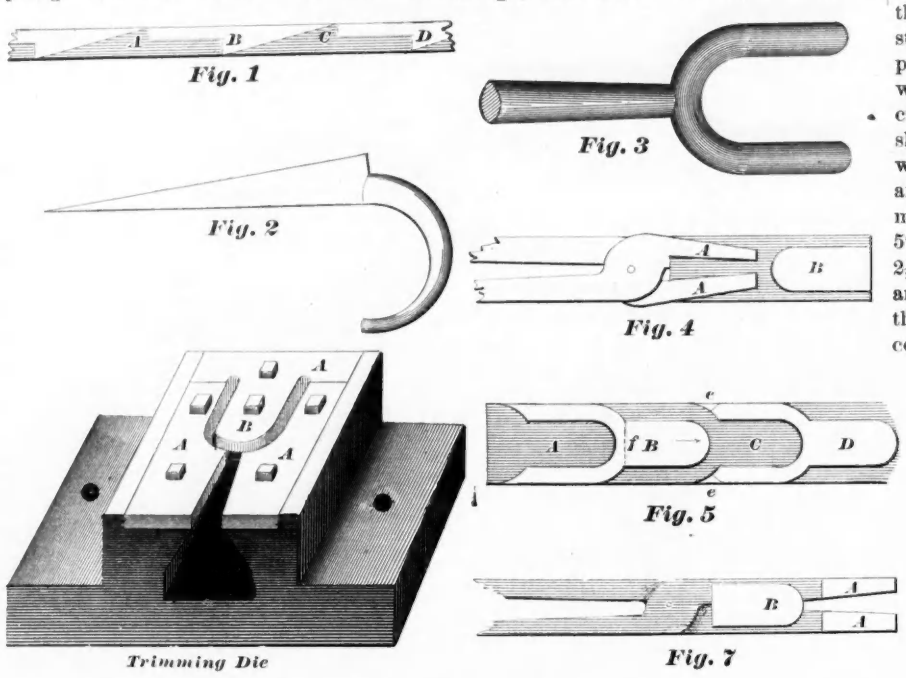


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 7

Details of Blacksmithing.

In carrying out this design the first operation was to punch the blanks for them, out of 2½″x½″ cold iron in the shape shown in Fig. 5.

The same plan could have been adapted to this which was applied to the staple-hooks already mentioned; that is, by using round iron, and by making the dies properly, shearing would have been powerful enough to have cut the blank out entire. It was, however, in this case, thought advisable to make a simpler die, and, therefore, one was made which would cut out a space represented by *A*. Now, by moving the bar along, this die would cut out *B*, and again it would cut out *C*, making one blank at each stroke, and probably compensating for whatever loss of time there might be over the other way by the ease with which the tools could be made and kept in order. These blanks were so calculated that the stock cut out of each fork between the prongs was the right amount to make the shank; and all the waste was the little corner on the end of each prong, caused by rounding the heel, as shown at *e e*. I think the distance from the root of the fork at *f* to the end of the tang-blank was 2⅝″, and the width 1⅝″. This left the prongs ½″ × 7/16″ × 2⅝″. These blanks next went to the trip-hammer man, who held them with tongs, which were intended to keep the shape of the prongs unchanged, while he drew down the shank. From the trip-hammer they were taken to the drop, where, standing endwise, upright in a die made to receive them, they were struck a blow, which opened them a little and worked the stock at the roots of the fork—changing the direction of its fiber from running straight across, to running obliquely, and prepared it for entering the next, which were the finishing drop dies. These were cut out, of course, exactly of the size and shape which the piece was intended to fill when finished. They were made of steel, and as perfect as the means at hand permitted. They should have been made of 5″ square steel. The largest available was 2½″ square, and they were built up of this and fastened in blocks of cast-iron. As they made over 50,000 forks, no objection could lie against this form of construction.

The forks, having a good heat taken on them, were struck a good blow in these dies, which had a further effect in laying the direction of the fiber at the roots of the fork, as it caused a flow of the metal—which was calculated to be in excess here—around, towards the ends. This was an essential point, as, after they were made by machinery, the use of refined iron was discontinued, and they were henceforth made of common iron, saving about a cent per pound. The common iron answered every purpose and gave good results to the tests to which the forks were subjected. From the drop they went to the trimming press to have the fins removed, after which they were rattled and sent with shining faces to their destination.

In the sketch of the trimming die, *A A A* are of steel, fastened on the cast-iron bed block by bolts as shown. The throat is cored out wide enough to pull the fork out after it is forced through the die. The tongue *B* rests on solid metal, the core parting here and going on each side.

Modern Locomotive Construction.

By J. G. A. Meyer.

FIFTY-SEVENTH PAPER.

Driving Wheels, continued.

Figs. 350, 351 and 352 represent the different views of a driving wheel designed for a ten-wheeled engine having cylinders 19 inches in diameter; Fig. 353 represents the sections of the spokes.

In this wheel the spokes are solid and the rim is cast hollow, with the exception of that part of the rim which covers the counterbalance *O, O, O*, extending from *u* (Fig. 250) to an equal distance on the other side of the center line; this part of the rim is cast solid. In order to avoid a shrinkage stress, the counterbalance is parted at *s, s*; these openings extend to the rim, but not through the rim; the latter is parted or cored through at *r* and in a corresponding place on the other side of the center line. The openings *r* are generally slotted and cast-iron liners driven in.

In this wheel the whole crank is cored out, the cored part extending to the axle, and leaving all around it an opening 1¾ in. wide, by which sufficient means are not provided for guiding the end of the axle when it is to be pressed into the hub of the wheel, sometimes giving considerable trouble in doing so. It seems to us that a few ribs cast into the core opening around the axle will be an improvement, by which considerable annoyance may sometimes be avoided.

It will be noticed that the hub of the wheel is counterbored at *b*; the reason for doing so is to allow the full diameter of the axle to extend into the wheel, bringing the shoulder of the wheel fit inside of the hub, instead of against the hub, as explained in our last paper. The object of this design is to prevent the breaking of the axle, which occasionally occurs when the shoulder of the wheel fit is pressed against the outside of the hub.

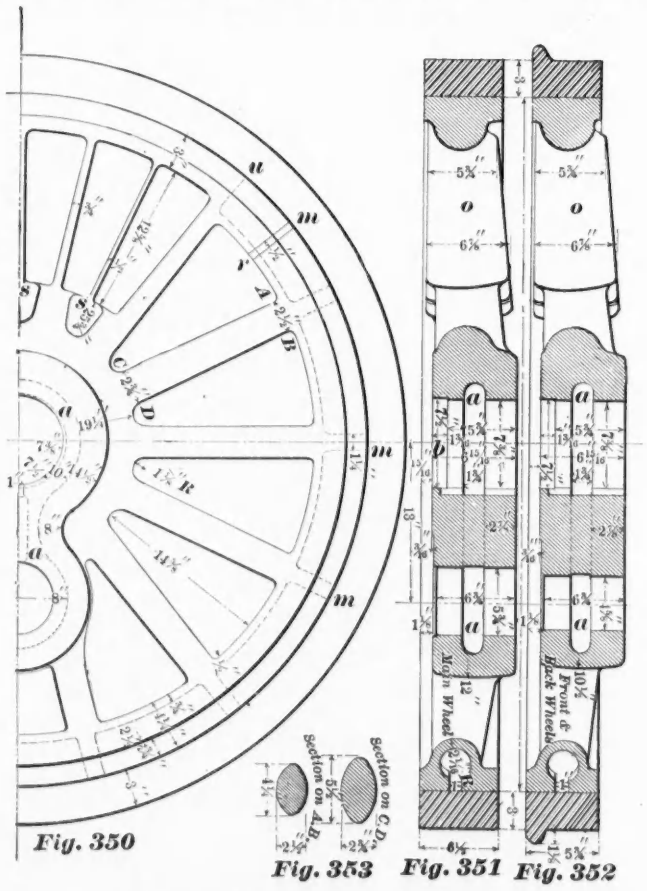


Fig. 350 Fig. 353 Fig. 351 Fig. 352

Modern Locomotive Construction.

The ribs *m*, *m*, shown in Figs. 345 and 350, are for the purpose of stiffening the hollow rims.

In some wheels the ribs are placed at the end of each spoke, as shown in Fig. 350; in other wheels they are placed at the end of each spoke and midway between the spokes, as shown in Fig. 345.

Figs. 354 and up to 357 inclusive show different views of a driving wheel designed for an eight-wheeled passenger engine having cylinders 19″ in diameter. In this wheel the spokes and rim are cast solid. One peculiarity of this wheel, not often found in others, is that the rim of the wheel center has a shoulder against which the tire is pressed. The object of this shoulder is to prevent the tire from slipping inwards when the flange is working against the rail. At first sight, it may appear that a shoulder of this kind is unnecessary, but when locomotives are fitted up with driver brakes, and these applied, the tire will in some instances become sufficiently hot to expand and thereby loosen it, and hence the necessity of the shoulder must be apparent.

We also notice that in the axle for these wheels the wheel fit is tapered; its large diameter is the same as that of the journal, and consequently there are no shoulders, such as shown in Figs. 341 and 342. This is another method sometimes adopted for the prevention of breaking the axles near or at the hub of the wheel.

The rim of this wheel is cored through in two places *r r*, and at the center r_2 of the counterbalance. In our opinion, the position of the openings *r*, *r*, r_2 are better located than the two openings shown in Fig. 350; because in Fig. 354 the distances between the openings are nearly equal, and the openings *r r* through the rim are placed between such spokes, where the strength of the hub is re-enforced by ribs cast between the spokes, the result being that in this wheel the openings through the rim will not widen as easily nor as much as the openings in the wheel shown in Fig. 350, when the axle is forced into the hub of the wheel.

Figs. 358 to 362 inclusive, represent a driving wheel, designed for an eight-wheeled passenger engine, having cylinders 18 inches in diameter. This wheel has solid spokes. The rim is cast hollow, but differs from those previously shown, in the fact that in this wheel the cored part in the rim does not extend to the periphery; it is closed, as shown in Fig. 362, and indicated by the dotted lines in Fig. 358. The only openings in the rim of this wheel are the core holes *w*, *w*; and ribs in the rim, similar to those marked *m*, *m*, in Figs. 345 and 350 are not used. The rim from *u* to *u* is cast solid, but the extra metal thus obtained is not sufficient for counterbalancing, and therefore two or four separate pairs of counterbalance weights, as the case may require, are bolted between the spokes. These weights, and the manner of bolting them to the wheel, will be illustrated in another paper. The hub of the wheel is cored out at *a a*, having small core openings *v*, *v*, extending to the axle.

In this wheel the spokes, as they extend towards the hub, incline outwards; wheels of this kind are sometimes called dished wheels. The object of placing the spokes in this position is to make room for a comparatively wide axle box; but there is a limit to the inclination of the spokes, for, if they are brought out too far, it will be necessary to spread the cylinders also, which is always an objectionable feature.

The wheels are usually forced on the axle with a hydraulic press. The pressure should be equal to about 9 tons per inch of diameter, so that an axle 6 inches in diameter will be forced into the wheel with a pressure of $6 \times 9 = 54$ tons, or an axle 7 inches in diameter, with a pressure of $7 \times 9 = 63$ tons

To add further security, keys are driven into the wheel and axle. These keys are generally made $\frac{7}{8}$ inch square for axles less than 6 inches in diameter; 1 inch square for axles varying from 6 to 7 inches in diameter; and $1\frac{1}{8}$ inch square keys for axles 7 inches and over in diameter.

The illustrations represent driving wheels such as are used on some of our prominent railroads; they have been taken directly from working drawings, courteously given to us by locomotive builders for the purpose of illustrating these articles. The designs of these wheels also indicate the study and care bestowed upon this subject by master mechanics, so as to obtain a strong and safe wheel, thereby greatly promoting the safety of the passengers.

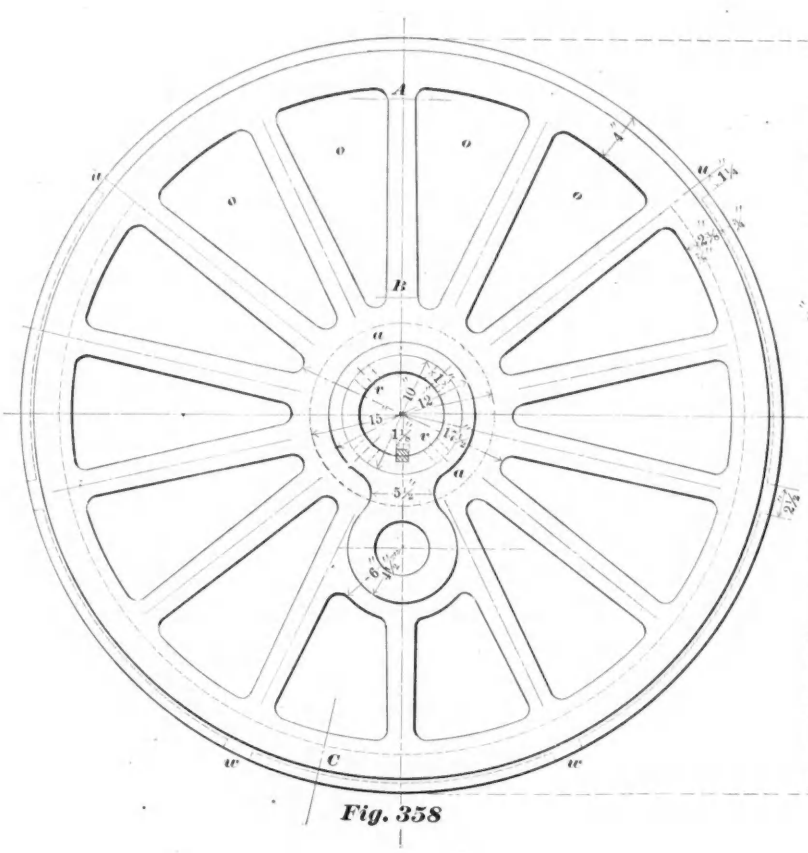


Fig. 358

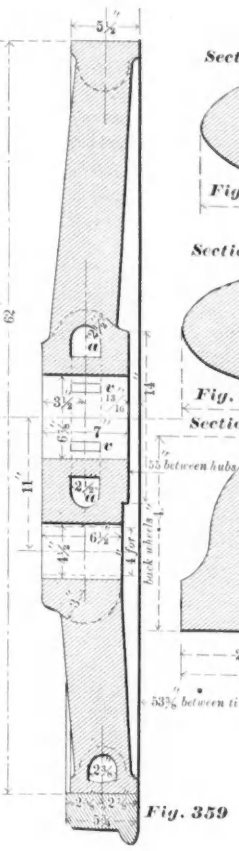


Fig. 359

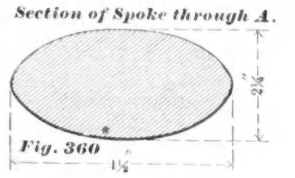


Fig. 360

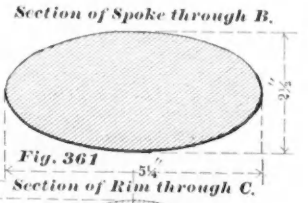


Fig. 361

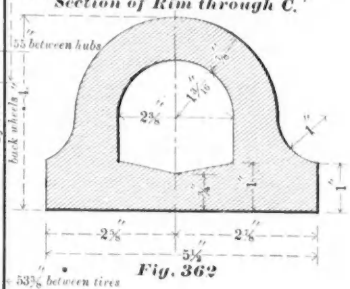


Fig. 362

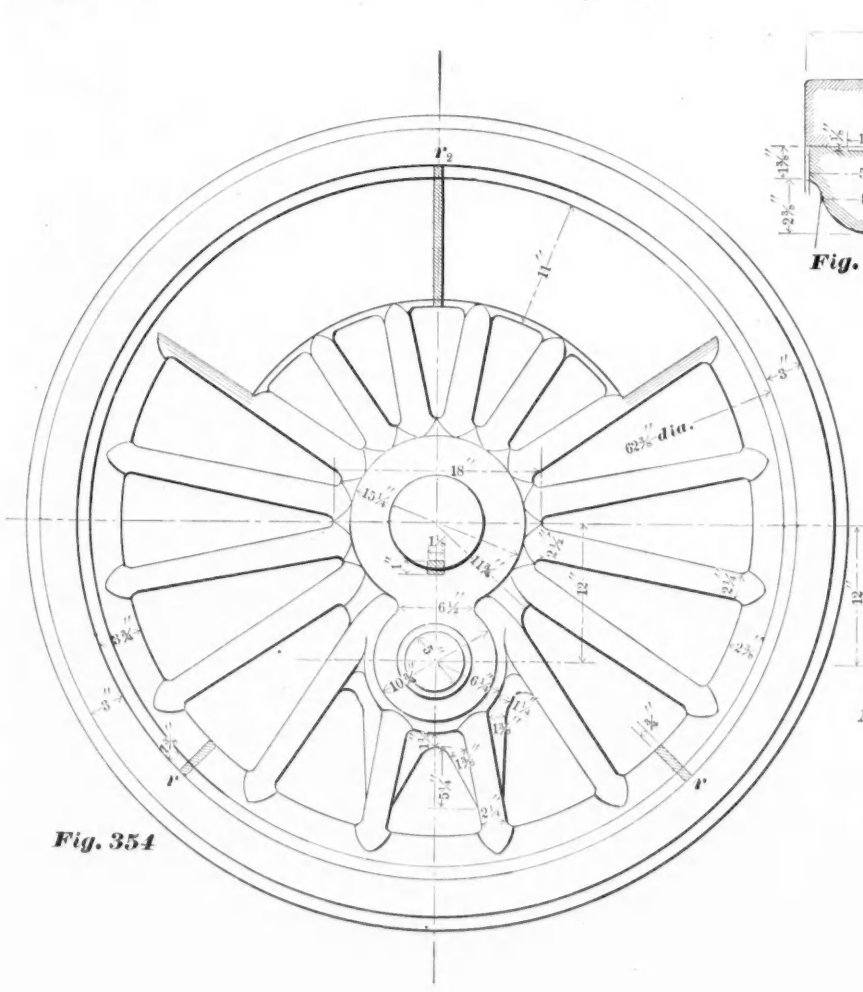


Fig. 354

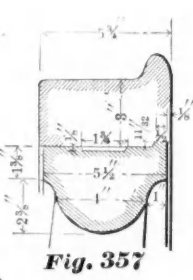


Fig. 357

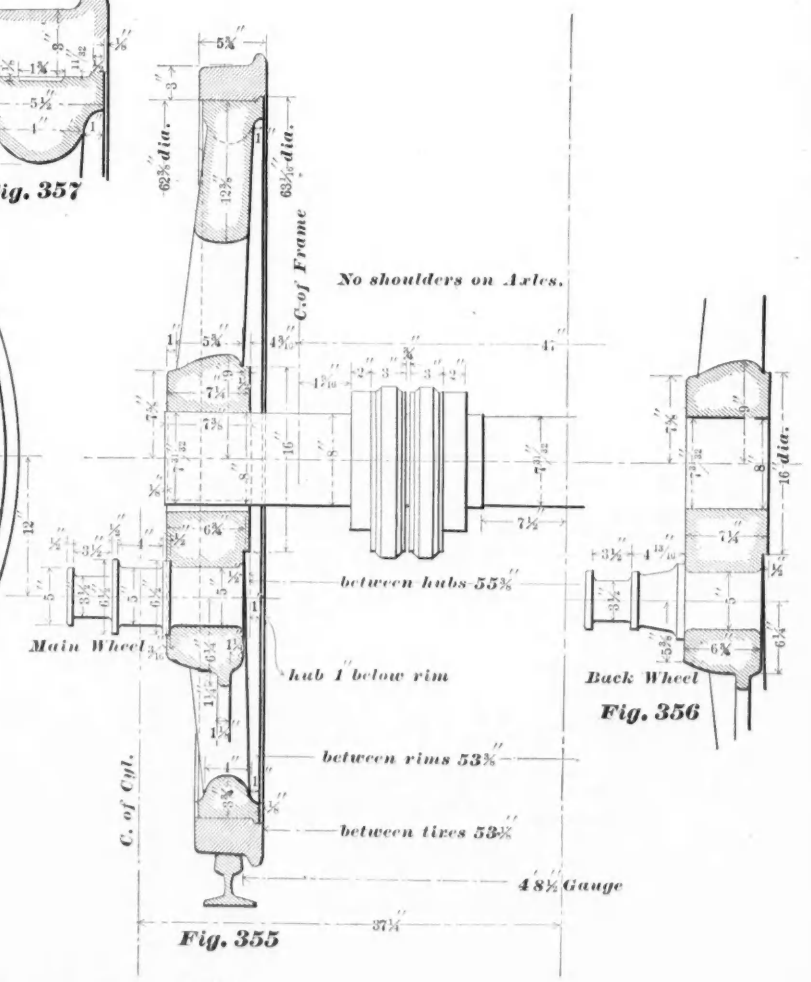


Fig. 355 Fig. 356

MODERN LOCOMOTIVE CONSTRUCTION.—SEE PAGE 2.

Railway car manufactories have been started up in all parts of the country during the past five years, and they all appear to have been doing a good business. Notwithstanding this, there is at the present time said to be a famine of railway cars. Who knows why this is so?

Car Wheel Patterns.

By Wm. Hultgran.

In making patterns for car wheels it is best to work from a full size drawing; if this is not furnished a good way is to make one on a board, planed up straight and sand-papered smooth. To secure a sharp outline of drawing, it should be made with a scratch awl, having its point made as per Fig. 1, so that it will not tear up the fibers of wood when drawing a line crossways to the grain; these lines should, to make them plain or visible, be gone over with a lead pencil. The drawing may be given a neat appearance, and at the same time be made more conspicuous by cross-hatching section lines with a blue pencil. Then to make it permanent, as it may perhaps be required to use it for references in the future, it should be given two coats of clear shellac.

The thickness of material that enters into the construction of pattern ought not to exceed $\frac{3}{4}$"; it is cut in segments, and to obtain the diameter of each course they must be spaced off on drawing, as shown in Fig. 2. A face plate is procured of the diameter required; it must be strong and substantial in every respect so that when used in the lathe it will not vibrate to the annoyance of the workman. A flimsy face plate should be shunned, as it is a source of danger to the operative, and may cause serious damage to the pattern, especially so, if, while turning, a vibration should take place at a moment when the pattern maker is off his guard, as it may then, no matter how slight, cause the chisel to catch and dig into the work. This tendency exists more, or is augmented, when using the turning gouge. It being impracticable to use a face plate of iron of the necessary diameter for the purpose named, it is made by the pattern maker, and, as a general thing, when larger than say 26 or 28 inches, as shown in Fig. 3, the arms are made in three pieces framed together by being notched out as per Fig. 4. On these are fastened the segment pieces, as seen in sketch, with glue and screws. A cast-iron plate is bolted on the back (see Fig. 3). The center block *a*, Fig. 3, on face plate should be of hard wood, or what is better, a piece of brass. If made of the latter a wood screw can be cast therein (see Fig. 5), to hold it in place. The center block will of course, be used a great many times, and should therefore be made of some hard material, so that by inserting the point of a trammel the center point or dot will not assume the magnitude of a big hole, and as far as accuracy is concerned, become useless, which would be the natural result if it is made of soft wood. The face plate is next put in the lathe and turned up true, its face made perfectly straight, and the exact center is established. Then keeping in mind that the pattern has to be turned on both sides, it must as a consequence, after one side is finished, be taken off the face plate and rechucked; hence, that side which presents the best facilities for so doing, should, as a mattter of convenience, be finished first. By referring to drawing we find the inside of pattern *A*, Fig. 2, to be the one, as it has no projection, and flange *B* is well adapted to chucking in presenting a face that will lay close to the face plate, and into which screws may be reliably entered for holding the pattern onto the same while turning. With that intent the trammels are set from the center line to point No. 1 in Fig. 2. A circle of that diameter is struck on the face plate; another is struck with a radius from center to point No. 2. It is then taken out of the lathe, and to facilitate the operations in building up the pattern, it should be placed on a block having a hole or pocket in its center to receive the hub of iron plate, as shown in Fig. 6. The block, if placed on the bench, must be high enough so that the face plate may be swung from one segment to the next in gluing without interference from the handles of hand screws. The thickness or height of block is, however, not essential when a stand, as shown in Fig. 6, is used, as we then have a surplus of room; it is a handy fixture, and one at least should be found in every pattern shop. A segment is laid out with trammels already set, which would be No. 2 in Fig. 2, and another No. 1 in Fig. 2 direct on the material to be used. In making the pattern they ought, which as a rule is the general practice, in constructing circular patterns, be one-sixth of the circle in length. They are cut out in the band or jig-saw, being careful to cut close to the lines, as they will be used as templets in laying out the five remaining segments required to complete each course.

It is a practice with some pattern makers to make a special templet for laying out segments. This habit the writer considers as a waste of time. The ends of segments are jointed together by being planed up on a shute board; they are glued together on the face plate, the circles on the same acting as guides whereby to place them, and held together with dogs, as shown in Fig. 6, while the hand screw or clamp is adjusted and tightened, strips of paper having previously been stuck on the face plate in such positions as to be directly under each joint. By using this precaution the pattern will not adhere, that is, beyond a certain limit, equal to the strength of the paper employed, and can easily be taken off the face plate, which would otherwise not be the case, as the pattern is liable to be held fast thereto, or tighter than desired, by the glue that has been squeezed out from joints. Then, to make everything safe and secure, the segments are, before removing the clamps, fastened to the face plate from the back with wood screws. A saving of material is effected by making the pattern hollow, as seen in the sketch; yet, to obtain solidity in construction, and to sustain the sides in withstanding the subsequent pounding that the pattern must receive when used in the foundry, a center or pillar is put in. It is glued up of round pieces, the first one being fastened to face plate with a couple of screws, simultaneously with segments, and of the same thickness of material. The next course of segments is then gotten out. Setting the trammels from center to point No. 3 in Fig. 2, we lay them out and cut them as before. The clamps are removed from face plate and the segments fastened thereon, faced off in the lathe. When this is done, a circle is struck with trammels as already set, to indicate the position of the following course. These operations are repeated in building up and gluing the remaining courses of segments.

It is a common practice among pattern makers, when constructing circular patterns, to cut out all the segments required at the start; this should, however, only be done when operating upon two face plates, or when the work is of such a nature that, in building up, each segment may be nailed on or temporarily fastened, independent of glue, which has not been given time to dry, and, as a consequence, cannot be relied upon for holding while the segments are being faced off in the lathe.

From the foregoing it may be surmised why, in certain cases, it is an advantage to lay out and cut each course of segments as they are needed, as by so doing unnecessary delays, such as waiting for glue to dry, are done away with, as it takes place while engaged as intimated, besides saving time by letting the work go ahead smoothly.

The material used should, to make good joints, be planed up straight and true on one side (the other being faced off in the lathe), then as it is evident that it is far easier to plane up a board, providing it is cut to a convenient length while yet square, than it is to plane up each individual segment, and as time may be saved by so doing, such practice ought to be adopted. For patterns in constant use, the material and construction should be such as to give the greatest amount of strength and durability, and as car wheel patterns are of that class, to attain the same the segments composing the flanges and sides of pattern should, where indicated by dotted lines in Fig. 7 and Fig. 8, be made of hard wood, say cherry or mahogany, as those parts are the most exposed to the injurious effects of the moulder's vent wire, this being also the case with the ribs.

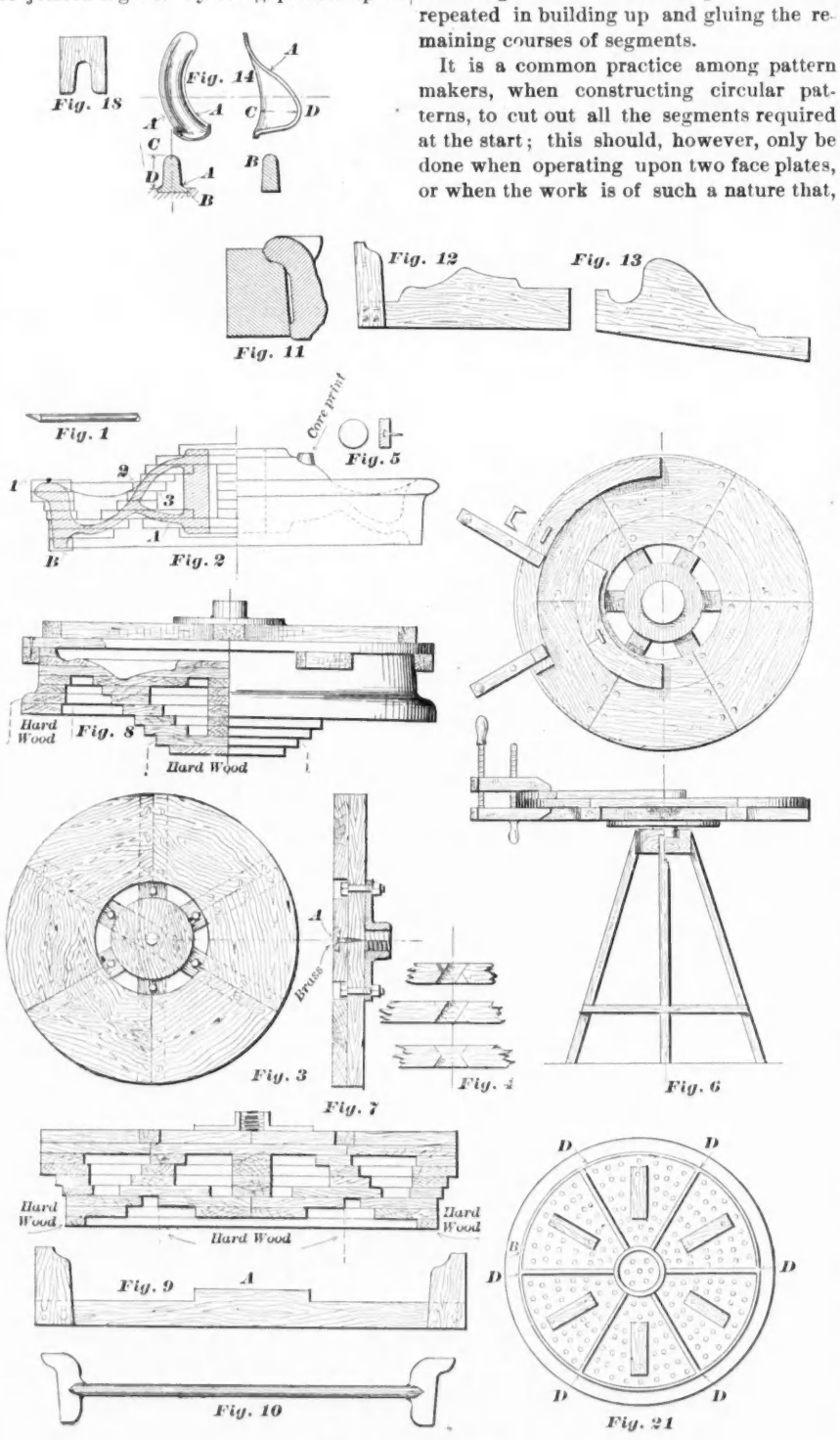
Having completed the building up of pattern as far as shown in Fig. 7, the tread of wheel is next given our attention. To determine when the exact diameter has been attained in turning, a templet, Fig. 9, is used as a gauge; it may be made from the templet or gauge used by the machinist in boring out the chills of which Fig. 10 is a sketch. Then if the pattern is turned up to fit the templet, providing it has been accurately made, there need be no fears about the pattern fitting in the chills upon reaching the foundry.

The tendency that sometimes exists in patterns to stick in the chill can be remedied by making the tread as shown in Fig. 11. The projection *A* on templet, Fig. 9, is used to gauge the depth that the face of the hub is below that of tread. This may also be done by placing a straight edge across the face of pattern and measuring with the rule, it being simply a matter of choice.

In turning the pattern on sides to a finish, to ascertain the amount of stock that must be removed to give it the exact shape desired, templets as seen in Fig. 12 and Fig 13 are required, the first named being the one that is brought into service in finishing the side of pattern presented. It is then given a coat of shellac varnish, and when dry sand-papered smooth, and as this last operation completes one side of pattern, it is, as before stated, taken off the face plate and re-chucked, as illustrated in Fig. 8. This is accomplished by fastening with screws from the back of face plate six blocks, three of which are seen in the sketch, equidistant from one another, and to a diameter that will allow them to be turned off on the inside so as to run true and equal to the diameter of tread on pattern, thus forming a chuck into which it is entered and fastened.

We next proceed to build up the remaining side or belly (if such a name may be permitted) of pattern. This done, it is turned up and finished, the templet Fig. 13 being used in much the same manner as that already described. If each segment course be turned down on its periphery to, say, within one-sixteenth of the finish, at the same time that it is being faced off, so that the inside corners of steps formed in building up will correspond with the curvature on drawing, it will, by referring to sketch, be apparent that they may in a certain measure be utilized as guides in turning up the sides of pattern.

Having selected the material to be used for the ribs, one of which is shown in Fig. 14, the number required is first laid out sideways from templet Fig. 15, and cut out with the bandsaw. Then as the fillet *A*, see Fig. 14, is worked out from the solid, it must be allowed for on the templet *A*, Fig. 16, which is used in laying them out on top. To hold them in position while cutting in the saw, a form seen in Fig. 17 will be found very convenient, the ribs being held in the same with a couple of wire nails as indicated in sketch. The ribs are next spaced off on pattern and mortised or sunk into the same about $\frac{3}{16}$ in. deep, as seen at *B*, Fig. 14. When they have all been glued in place, to make them uniform in height, that is from *C* to *D* in Fig. 14, they should be faced off in the lathe. This operation being completed, the pattern is taken off the face plate and the use of the latter is discarded. The templet *B*, shown inside of *A*, Fig. 16, is used in laying out the finished size of the ribs (see Fig. 24), and in working them out to make



Car Wheel Patterns.

them as near alike as possible the gauge (Fig. 18) is employed. We have seen wheel patterns with ribs made as at *B*, Fig. 14, and the fillets made of leather or even worse, out of putty, will last for a short time, of course, and are employed may be for the reason that the method of application is cheap, yet, if it is advisable to use an independent fillet, the only thing I know of that will favorably compare with, and in fact is at times superior to wood, is that known as the "flexible metallic fillet," which can be applied very rapidly.

Again, if the ribs are mortised into the pattern and made of maple, as described, they will, as far as ordinary usage is concerned, make the pattern practically indestructible, and from the knowledge of the fact that the "best is the cheapest" we are more than paid for the extra time and labor expended in their production.

The pattern is then made complete by varnishing and providing it with the necessary core prints.

It is an important matter that the ribs be spaced off and made exactly alike, to get a casting that will balance; this is also true when turning the pattern. In re-chucking the same if it is not caused to run true on its periphery as well as face, be the defect ever so slight, we cannot expect a wheel that is perfect, and as whatever defects that exist in pattern may by chance be increased in the foundry manipulation, we may venture to say that the frequency of so, called chill cracks in castings from a certain pattern, which often puzzles the car wheel moulder, all other conditions being the same, may sometimes be traced directly to a faulty construction of pattern. This is perhaps also a factor in the lifetime of wheels.

The core boxes are usually made of iron. The method in making the pattern for the one illustrated in Fig. 19, which is used in making the chamber core, is that which governs the construction of circular patterns, hence a description will not be of interest. The underside of core is formed in the pan in which it is baked or dried, the top being struck off with the sweep *a*, seen in sketch. By referring to this the operation will be readily understood.

An improvement on the ordinary wooden box for making the center core is shown in Fig. 20. The patterns required in producing the casting are too simple to need any explanation. It is merely a cylinder having a cut $\frac{1}{8}''$ wide through one side at *B* and provided with levers *C* and *D* for clamping it together, in which condition it is bored out to the desired diameter. In making the core the levers are pressed down as indicated by arrows in sketch, thus clamping it together, as will be perceived by referring to plan view of Fig. 20. The core sand is then put in and rammed up; the box is rapped a trifle so that the sand will not adhere; the levers are raised, allowing it, from its peculiar construction, to expand. Then, as the diameter of box is larger than that of the core, it can very easily be lifted off.

The construction of flasks in which car-wheels are moulded and the appearance of the mould, when ready to receive the iron, is shown in plan view and section, Fig. 22 (that is with the exception of clamps for holding the flasks together while pouring). The bottom plate *A*, in Fig. 22, of which Fig. 21, page 4, is a plan, the under side being presented to view, so as to show clearly the flanges *B* and *C*, and the radial ribs *D*, is perforated with vent holes as seen, and six hard wood blocks are bolted on the same, to take the blows of the sledge-hammer, in case the moulder should find it necessary to use one in adjusting the plate. By an intelligent examination of plan view Fig. 21, the construction of pattern suggests itself and consequently does not require a description, except the vent holes, which should be bored in the pattern, and be given plenty of taper or draft, as shown in sectional view Fig. 22. The nowel *E* is in other words a ring of sufficient depth to take in the belly of pattern and leave a couple of inches between the center core and bottom plate. Three lugs *F* are cast on its upper edge and fitted with guidepins *G*. The pattern is built up in segments and turned up in the lathe. The pattern for chill *H*, Fig 22, is made in a similar manner; it is provided with lugs *I*, placed in same positions and directly above the lugs *F* on nowel. Holes are drilled in the former, to fit the guide pins *G*. It is also supplied with four lugs *K*, seen in plan view of Fig. 22, to coincide with the lugs *R* on cope, by which the two (the cope and chill) are bolted together; see plan of Fig. 22.

In turning up the inside of chill pattern it should be remembered that the casting, as a matter of necessity, must be finished and provided for in the pattern; for that purpose $\frac{3}{16}''$ will be sufficient; that is, the inside of pattern is $\frac{3}{8}''$ smaller in diameter than the finished size. Trunnions *L* are cast on chill diametrically opposite one another, as shown. In making the pattern for the cope, the outside ring *M* and that on the inside *N*, which supports the head of the gates, are made first. In building them up, to further the progress, two face plates should be operated upon, as by such procedure the glue is permitted to dry on one while we are building up on the other. When the rings have been finished the bars *P* are given attention. After they are cut to approximate size, and planed up parallel on sides, we nail them temporarily together. The exact shape and size is laid out on the outside pieces, and the whole is cut to shape in one operation. They are next taken apart and planed down to the required taper to make them mould, and the edge *T*, which should follow the profile of pattern within one inch, is beveled off. The number of bars is spaced off on the rings and fastened, as shown in plan of Fig. 22, with glue and nails. The cope is fitted with seats for chaplets, of which one is shown in enlarged view, Fig. 23, and seen in position of *V* in sectional view of Fig. 22. The seats on cope, of which three are required, are round bosses having holes drilled in them to fit the pin *A* on chaplet, and of a diameter equal to that of shoulder *B*, Fig. 23.

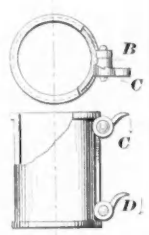


Fig. 20

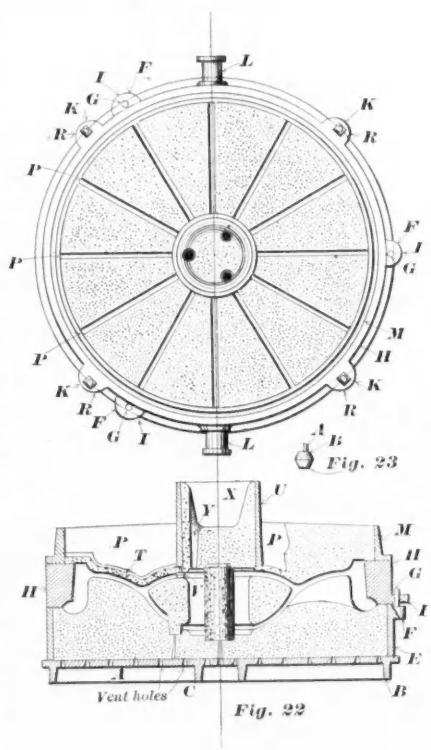


Fig. 23
Fig. 22

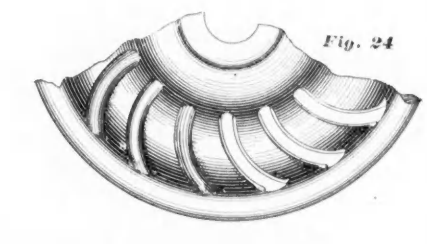


Fig. 24

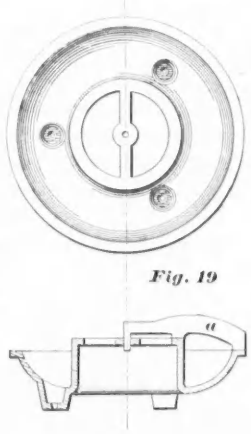


Fig. 19

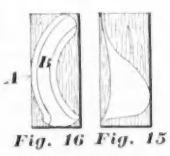


Fig. 16 Fig. 15

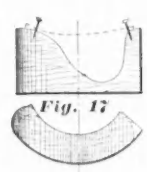


Fig. 17

CAR WHEEL PATTERNS.—SEE PAGE 4.

It appears as if more than the usual number of calendars for the year 1888 had so far appeared. The great number received prohibits noticing them in detail. They are for the most part artistically designed and executed, and we have no doubt are well received wherever they go.

Dynamite has worked wonders in this country. Whenever there is an explosion of gas in gas works, it is placed to the credit of a dynamite bomb, and a harmless piece of gas pipe is a terror everywhere. The dynamite wag has the preference by long odds.

The breakdown of one of the pumping engines of the Jersey City water-works, by which a considerable portion of the city was left without water, should emphasize the importance of duplicating pumping engines, especially old ones.

Satisfactory experiments have been made in Germany in the way of photographing moving bullets fired from a gun. These photographs are said to show very clearly the waves set up in the air by the motion of the bullet.

It appears that it is not to be clear sailing for the Poughkeepsie bridge. A joint resolution is to be introduced in the senate and house, requiring the removal of the stone piers, which it is claimed have been erected without permission of the United States, and to the detriment of commerce. It looks as if the United States has a good cause of action.

The American Institute of Mining Engineers will hold their fiftieth meeting at Boston, beginning on Tuesday evening, Feb. 21.

Design and Construction of Machine Shops, Boiler Shops, Blacksmith Shops and Foundries.

BY W. H. HOFFMAN.

FIFTH PAPER.

I once heard a foreman blacksmith say that the universal practice in regard to the construction of smiths' shops was to place the matter of designing them in the hands of the boss machinist, or machine superintendent, and, after completion, turn it over to the boss blacksmith. The writer knows of several instances of this kind, and fears that this course is followed too often.

A shop of the size illustrated in a previous paper is of course calculated for a large production. It will turn out all the forgings for sixteen 100 horse-power engines per month.

Like the foundry, the blacksmith shop for any large machine works should have its own power, or, in other words, its own boiler, for driving the steam hammer, blower, and drops. The traverse cranes, or trolleys, should be strong and simple in design, all being operated by hand, with differential blocks as a medium of hoisting. At least two of the forges should be sufficiently large to heat forgings that require the service of the steam hammer, these being conveniently located for reaching the hammer and central traverser.

The tool forger and dresser should be in the corner nearest the machine shop, and should have a steel rack erected near his forge large enough for the necessary sizes of square, round, flat and octagon bars. A set of light platform standard scales placed near the steel rack, will enable the tool forger to render a correct account of all material leaving his hands. I consider the matter of accounting for material one of the most important in the line of management of any large establishment.

In the first place, no workman in a machine shop should order any tool made in the blacksmith shop, without first receiving a written or printed order from his foreman. After each tool is finished by the tool forger, he should weigh it, and mark the weight on the order coming from the machine shop foreman. At the end of each week the weights of the pieces cut from the new bars, can be compared with the finished tools; at the same time the weight of the waste pieces or scrap should be taken, thus making a correct accounting of material. This should be turned in to the main office at regular intervals.

In building the furnace for the steam hammer, care must be taken in forming the roof and the throat, in order to obtain rapid heating results, which are very necessary in smith shop work. The roof must not be too high, and the grate area must be properly proportioned to the heating chamber. All things considered, I believe in a wide furnace, and a roof as low as possible, after making allowances for heating a shaft from 8″ to 9″ in diameter.

The writer designed a furnace, a short time ago, calculated for work of this size, which had some novel features. One of these novelties consisted in a swinging extension on the side opposite the main heating door. This extension was large enough, when bricked up, to allow an irregular piece, 14″ wide and 5″ thick, to pass two feet beyond the usual side line of the furnace. It is so arranged that, in ordinary work, it can be swung out of the way, and a shaft can then be passed through any distance required. When the extension is in use, there is a curved side, next to the grate, which will carry the flames entirely around the end of the piece, the heat at this point being very intense, for the reason that the curved flue is contracted, in blow-pipe form. The pieces to be heated being thicker at this end, require rapid heating, in order to keep pace with the central chamber, and by making the furnace in this form we make a chamber $5\frac{1}{2}$ feet wide do the work of a $7\frac{1}{2}$ foot furnace.

Another point in the construction is the adjustable grate. Four square iron posts

are placed in the grate chamber, that extend from the level of the furnace floor to the bottom of the ash pit, and in these posts square slots are cast at intervals of 4″. By this arrangement the bars can be raised or lowered to suit the work on hand, thus saving fuel, and at the same time presenting a small fire for light work and a heavy one for large work.

In heavy work, especially, there should be a thick, bright fire, supported by a heavy blast, while the stoking must *not* be frequent.

In working thin flat bars, the grates will be near, if not quite at the top notches, thus enabling us to reduce the blast, as the incandescent fire near the floor will do good work with a moderate blast.

The remaining new feature was the manner of setting the boiler. The ordinary method is to place a horizontal cylinder or flue boiler directly over the roof of the furnace, and lead the gases from the throat back through the flues, or under the shell of the horizontal boiler. My plan introduces a vertical tubular boiler, placed at the end of the throat of the furnace and directly under the *stack*.

The boiler has a regular set of bars, with fire and ash doors complete, opening on the side, so that when the furnace is not in operation, steam can be made by building a fire under the boiler. A damper or sliding door shuts off the furnace throat at will.

The boiler stands central with the supporting columns of the stack, these being separated sufficiently to allow for the removal of the boiler at any time that repairs may be necessary. A vertical side flue conducts the gas to the stack, *outside* of the boiler when necessary.

There are so many good steam hammers made in this country now, that the blacksmith has no trouble in making a selection, as he cannot make a serious mistake with any of the standard machines.

The mistake generally made in purchasing a steam hammer is in the *stroke*, as they are frequently too short in this important item. A shop of the size under consideration requires a 24″ to 30″ stroke hammer, and nothing less will give good results.

The regular working forges should be far enough apart to be convenient for the smiths and the strikers, for in a cramped shop one-half of the help are waiting for the other half to finish their work.

The blower should be driven direct by a small engine attached to the blower frame, the speed being adjusted by hand when necessary, by detaching the governor.

All steam and air pipes should be above the line of the floor, to avoid water, and to leave them convenient for repairs. Around the water tubs, or tanks, there should be a basin placed below the tubs, and the basin should be connected to the drainage system.

At each end of the raised turret top on the roof, should be an exhaust fan driven by the blower engine, to free the shop at all times from smoke and gas. As shown on the drawing before mentioned, the iron stock of all sizes is stored conveniently for unloading from the main yard track, and is entirely under cover, while near it is the iron scrap-bin, in which is collected all the iron scraps intended for blowing by the furnace and hammer.

A straightening and forming table, with suitable slots, and liberal length and breadth, will complete the outfit of large appliances.

Three arc lights will give ample light, but these must be the swinging, or adjustable type, in order to be convenient when working large pieces under the hammer, and there should be one medium sized drop, for duplicate work, and any of the standard machines will give economical results.

The *Engineering and Building Record* of January 14 has an interesting and instructive article on the advantages of navigation of the Kanawha river. Our contemporary says, getting its figures from a report of the engineer in charge:

The saving in freight over those by rail is very great. The charge for *towing* 263 miles from Charleston to Cincinnati is 25 cents for 2,000 pounds, or about one-twelfth of a cent per ton mile, and the total additional cost for care of barges, pumping, wharfage, piers, etc., would increase this one-quarter of a cent per bushel, or to $44\frac{3}{4}$ cents for 2,000 pounds, or a little less than one-sixth of a cent per ton mile. For longer distances this would be still less. For operators who own their own barges and towboats, the total cost, including wear and tear, is about 28 cents for 2,000 pounds.

By rail the cost between Winchester, Ky., and Covington has been $2 70 per 2,000 pounds; Charleston, W. Va., to Lexington, Ky., 190 miles, $1 82 for 2,000 pounds.

These figures should be interesting to those who see nothing wrong in obstructing navigation on the Hudson river.

LETTERS FROM PRACTICAL MEN.

Cutting-Off Tool.

Editor American Machinist:

I send you herewith a sketch of a simple and effective cutting-off tool, with the hope that, at least, makers of cutting-off machines may see its merits and adopt it in place of the tools now furnished with such machines.

Referring to the sketch, *A* is the holder, slotted lengthwise to receive the tool, *B* the whole fitting into the tool post or block, and where set screws are used to hold the tool in place, a gib should be used, to prevent the set screws from indenting the tool.

The holder should be made of good cast-steel hardened and tempered to a blue color, while the tool or cutter can be hardened on its upper edge throughout its entire length, if desired.

The tool should be projected beyond its holder sufficient only to reach the center of the bar being cut, in order that the cutting edge may be as well supported as the case will permit.

The tool should be sharpened by grinding on the end only, so that its thickness may be maintained to the extreme point, and that the top of the tool may always coincide with the center of the bar being cut off.

This tool has proven so satisfactory after repeated trials with both solid forged and sectional tools that I am confident that it will repay a trial at least.

E. F. Bengler.

The Association of Foundry Foremen.

Editor American Machinist:

In your issue of Jan. 21st Richard M. Whittaker makes the remark: "I would like very much if the Association of Foundry Foremen was extended outside of New England, so that I might be able to take advantage of it, in the hope of awakening an interest in the foundry," etc., etc., in all probability expressing the feelings of many foundry foremen. For the benefit of all interested, a few remarks relative to the association, published in the columns of your esteemed paper, may be productive of much good, in more fully acquainting foundrymen with the origin and objects of the association.

A few months ago the firm for whom I work sent me on a trip of observation among some of the leading foundries of New England and the Middle States the trip lasting a month and embracing foundries between Boston and Baltimore. Impressed by the benefits of the trip, in meeting so many foremen, who, in many practices and ideas, varied greatly and in many agreed, and having seen many new ideas, as well as many old, and, as I thought, obsolete ones, in daily practice, the thought occurred to me, and made a great impression upon me, that few men worked for a firm who were progressive enough to think of sending a foundry foreman on such a trip, but that every foreman I met was glad to exchange views with me; therefore an arrangement by which all the foremen so inclined might meet at one time and place must be productive of a great deal of good.

I mentioned my intention of trying to bring about such a meeting to the president of our firm, Mr. Henry R. Towne, who at once saw the benefits to be gained, and gave me every encouragement and all the aid in his power. The result was a meeting and organization at Springfield, Mass., Dec. 6th, 1887. The association is not confined to New England, but, on account of the labor involved in such an undertaking, I deemed it best to begin with a small area of country, as the undertaking was an uncertainty, and, until an interest had been awakened, few would care to travel a great distance to a meeting of an association which was yet unborn and might "end in smoke." But our organization is perfected and we have come to stay, and, we hope, do much good.

I will be pleased to give full information relative to the association, to all who wish for it and who will send me their address.

Jno. P. Pero., Sec. N. E. F. F. A.,
Foreman Yale & Towne Mfg. Co.'s Foundry.
Stamford, Conn.

"Ice in a Steam Pipe."

Editor American Machinist:

In reply to J. Torrey's "Ice in a Steam Pipe" I would say that my opinion is that turning on steam would have no effect on the ice, even though he used 90 pounds pressure, on account of the air and water preventing circulation.

I once thawed out a frozen sewer pipe. I did it as follows: I dug down to the end of the pipe at cesspool, then run a half-inch pipe back in soil pipe until I struck the ice. The distance was 25 or 30 feet. I then connected the pipe to my heating boiler in cellar, and got up steam to about 20 pounds; in about three hours I had it open. It was a 3″ soil pipe; the distance the pipe was frozen I do not know, but should judge about 6 feet. I have a stone walk at door of house where pipe runs under, and I think it froze the width of the walk.

If Mr. T. could run a $\frac{1}{4}$″ steam pipe through his frozen pipe, he no doubt can thaw it open. He would of course have to use higher pressure on so small a pipe.

Geo. E. Stauffer.

Stroudsburg, Pa.

Editor American Machinist:

Mr. J. Torrey wishes to know if any one has had experience with ice in steam pipes.

As he says, circumstances will differ. It depends altogether upon circumstances whether steam at any pressure will work its way through a pipe that is blocked with ice. It has been my experience that if the ice in the pipe is so situated that the water from the melting ice and condensed steam will flow back through the steam, thus exposing the ice to the hot steam, the pipe will be quickly opened. But if, on the contrary, the pipe is horizontal and the temperature is very low, steam at any pressure will not work through. It is my opinion that if the circumstances are favorable to the steam, the ice will be melted quickest with the low pressure, as steam at a low pressure parts with its heat more quickly than steam at high pressure.

S. A. Smith.

Evansville, Ind.

Editor American Machinist:

I notice "Ice in a Steam Pipe" in a recent issue. In reply to same will say, having proper drip to pipe, ice can be readily melted by "letting on steam," but the air in pipe must be removed if ice is any distance from the boiler.

W. P. Davis.

Editor American Machinist:

Mr. J. Torrey's experience with a frozen steam pipe has been a frequent one with me. My practice has been to find the lowest point in the pipe and there build a small fire under the pipe and wait patiently for the circulation which naturally takes place to finish the job, which it always does. My last experience was with 65 feet of 1″ pipe frozen solid. The pipe in this length had a fall of about 12″, and was thawed out in less than one hour. Steam of high or low pressure I do not think would have much effect if the supply was above the "freeze." If below it and without sinks in the pipe between it and the supply, either high or low pressure would work equally well.

F. L. Johnson.

Editor American Machinist:

In the Machinist of January 21st, J. Torrey asks for information in regard to melting ice in pipes by steam.

Where there can be no circulation, steam will act very slowly upon the ice. In one case a pressure of 30 pounds was maintained in a one-inch pipe for six hours, and about five inches of the pipe was cleaned out. Increasing the pressure would have no perceptible effect.

If the pipe were inclined in such manner that the water would flow away as fast as formed, the action would doubtless be much quicker. But in any case it would make a man feel "tired" if the pipe were needed for use.

W. G. Richards.

Steam Domes and Drums and Mud Drums.

Editor American Machinist:

In my recent mention of steam domes and drums and mud drums, locomotive and marine boilers were by an oversight not excepted; stationary boilers only were meant.

It does not follow that because I advocate a domeless boiler that the steam pipe is to be attached to the shell direct. I have known the water to rise to the top of a dome 48″ above the shell, when the actual height of water was only 5″ above the tubes; no fault of the boiler, however. I still maintain that if the feed is continuous—by way of the mud drum—no scale or mud will be found in that drum. I do not forget that the "neck" is 6″ or 7″ in diameter. There is one here that a two hundred pound man can get up through easily. Now after several years' practice with domeless boilers, and with steam from 60 pounds to 120 pounds, I want no other.

If the owner of that mill at Indianapolis, who is troubled with wet steam, will take a pipe two-thirds the length of his boiler, and will put it in through the front head, plug or cap the rear end of pipe, and put three rows of $\frac{1}{4}$″ $\frac{3}{8}$″ or $\frac{1}{2}$″ holes along the top of pipe. (size of holes to be governed by area of cross section of pipe) and place the pipe about 1″ to 2″ below the top of shell, he will get dry steam unless he is trying to get 80 H.P. out of a 40 H.P. boiler. Place safety valve on this pipe outside of smoke box, also a $\frac{1}{2}$″ or $\frac{3}{4}$″ globe valve to get rid of *condense* after standing.

Please notice that I said if a drum must be used it might as well be on the outside of wall and be called a trap or heater. The feed itself could not well be a trap.

Since this subject has come up others have told me that they find nothing like mud or scale in their mud drums; they feed continuously.

That $1\frac{1}{2}$″ in 14 feet lower at back end is a matter of opinion; I want mine level; the boiling of the water will throw the sediment back just as well, and it will drop into the drum if the feed is off. Now if Mr. Hetherington has had the running of domeless boilers, and knows whereof he speaks, for one, I would be pleased to see him in print again.

J. A Beaton.

Albuquerque, N. M.

Set Screws in Heavy Machinery.

Editor American Machinist:

Permit me to offer these suggestions in connection with the recent discussion at the meeting of the American Society of Mechanical Engineers.

One is that the thread for the set screw can often be most usefully obtained on the casting, or similar heavy part, by sinking a loose nut into it in a carefully cored pocket or recess. Thus a full thread can be obtained (rare in cast-iron when tapped out of the solid), for the set screw, and if at any

time it stretches, or becomes loosened in any other way, it can be wholly renewed at the trifling expense of a new nut.

A second is that for some few cases it will pay to sink a nut, or threaded bushing, into the casting, to be screwed in dead solid. Into this the tap bolt, if that is what is meant by "set screw," can be tapped with the usual slightly loose fit in the thread.

A third is that, when it can possibly be used and tolerated, a standing bolt or stud is far preferable to any tap bolt, especially when it must be cored in cast-iron. In rolling mill machinery, in which the vibrations are often extreme, and many bolts are liable to be broken, it is a well-approved practice to use standing bolts, in which the part tapped into the solid iron is $\frac{1}{8}''$ or $\frac{1}{4}''$ larger than the upper or outer end, which receives the nut. Between the two ends the body of the bolt is made square, so that if, by some heavy blow, the outer, weaker end is broken off, the root or inner end of the bolt can be backed out of the hole, leaving the thread almost invariably in perfect condition.

Neither of these devices is new, but each is thoroughly good in its place.

Pittsburgh, Penn. P. BARNES.

Rules for Screw Cutting.

Editor American Machinist:

Simple rule for finding the proper gears on a screw lathe when the stud and cone make the same number of revolutions:

Multiply the leading screw and the screw to be cut by the same number, the result will be, properly proportioned gears will be found.

Example: Leading screw 6 to the inch, screw to be cut, 14 to the inch. Take 4 for a multiplier, $6\times4=24$=number on stud; screw to be cut, $14\times4=56$=number on screw. To cut 9 threads to the inch, as above: Leading screw $6\times4=24$; number to be cut $9\times4=36$.

Any number may be taken for a multiplier, and will, if applied as above, give the proper proportion gears. Gears on a screw lathe having the stud and cone running the same speed should represent the same fraction, when placed as numerator and denominator, that the lead screw and the screw to be cut represent when placed as numerator and denominator. Example: Lead screw 6, screw to be cut 12, placed as a fraction $\frac{6}{12}$. Now any two gears which will represent the same fraction will cut 12 threads to the inch, as $\frac{24}{48}$ or $\frac{30}{60}$ or $\frac{36}{72}$, etc. If, therefore, you place the lead screw and the screw to be cut as fractions — $\frac{6}{12}$, and multiply both the numerator and denominator by the same number, you get gears which will cut the desired threads and will be in the same proportion to each other that the leading thread and the thread to be cut are to each other.

All the latheman has to do on a modern lathe is to multiply the lead screw and the screw to be cut by the same number, and his gears will be right every time.

I have had very good results from the use of turpentine and camphor in cutting threads with a single point on hard steel. I like it better than lard oil. The men in our shop call for it when cutting steel screws or Norway iron screws. I mix $\frac{1}{4}$ pound camphor to 1 gallon turpentine. This preparation, applied with a brush as oil is applied, will give better results. A thread tool will last longer and cut smoother than with any oil I ever used. We have been using it for the past four years with the above results.

WILLIAM FOSTER.

The Car Wheel Question.

Editor American Machinist:

I could not avoid noticing your answer to Question 11, in the January 7th issue, and quite frequently I have seen answers which seem to have been given with as little thought. The questioner says the power is applied to the car (not the wheel), and, of course, no matter to what point on the car it is applied, it is in reality applied to the center of the wheel. But you go outside of the question to make a blunder, and state that if the power is applied to the wheel above or below the center, the effect is the same. I claim that if the power is applied at the top of the wheel, it would only require one-half as much to overcome the rolling friction on the rail, as if applied at the center, and if you apply the power at the bottom of the wheel, you would have to exert a force equal to about one-quarter the weight on the wheel, to overcome, not the rolling, but sliding friction; and if you apply the power to a point below the wheel and rail, by means of an arm rigidly attached to the wheel, the car would move backwards when you pull forwards on the arm.

It rather casts a cloud on all your other answers when you reply to such easy questions in so hasty a manner.

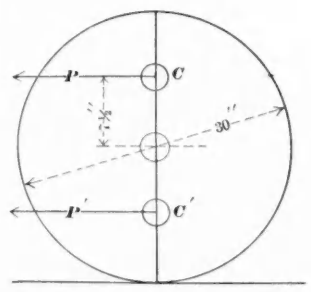
WILLIAM MERRILL.

East Saginaw, Mich.

[Thus are we reminded that "to err is human." We plead guilty to having answered the question without having spent a great deal of time in studying it; but this was simply because we did not consider it sufficiently difficult or complicated to require much time in the answering, though, of course, we aim to spend sufficient time to answer questions correctly.

In this case, we thought the question could be answered correctly without spending much time over it, because it is really a simple question, involving a few well-known principles of mechanics, which, if our correspondent had been a little more familiar with, he would not have been so entirely wrong as he shows himself to be by the above letter.

For his benefit we will go over the matter and try to make it plain, and, for convenience, reproduce the cut.



The question, as stated, clearly indicates that the power is *fastened* (not "applied," to the car, as our correspondent has it), and in one case is to act upon wrist-pin C, and in the other case upon wrist-pin C', in the direction indicated by the lines P and P'.

The questioner wished to know how much power would be required to move the car in each case, and we answered that we could not tell exactly, but since he was particular to state the diameter of the wheel and the distance of the wrist-pins from the center, we surmised that he wished to know what effect this distance would have upon the amount of force necessary to apply to the wrist pins to start the car. We therefore do not think we were going very much outside of the question by stating that, since the wrist-pin radius was just one-half the wheel radius, the force required would be just twice as much as if applied at the circumference.

There are several ways of demonstrating the truth of this statement, but perhaps the clearest demonstration is the following: If force were to be applied to either wrist-pin to turn the wheel just one revolution, the car would, of course, be moved over the track a distance equal to the circumference of the wheel, and in doing this, the wrist-pins will have moved just one revolution in a circle the circumference of which is just one-half that of the wheel. Now, since the tractive force upon the rail is exactly equal to the force required to move the car, and the force applied to the wrist-pin must exactly balance it, though acting through one-half the distance, it follows that the intensity of the latter force must be just twice that of the former. This is in accordance with the familiar law, that power is the product of force, multiplied by velocity—a law which is based upon the fact that a given force, acting through a given distance, is exactly equivalent to a force twice as great acting through half the distance.

And since the force would move exactly the same distance in making a revolution, whether applied to wrist-pin C or C', it is plain that there would be no difference in the amount of force required, no matter which pin it acted upon.

If the force were to be "applied at the center of the wheel," it could have no rotative effect whatever, and consequently would produce no motion.

It is evident, upon a moment's consideration, that our correspondent is grossly mistaken as to sliding friction, because, under the conditions given, the car could not be moved by the force without turning the wheel, no matter where the wrist-pin might be located, and of course there would be no sliding friction. It must not be forgotten that, according to the terms of the question, the force is "made fast to the car." We infer that it was overlooking this important fact which is partly responsible for the fact of our correspondent being so entirely mistaken about the matter.

We hope we have now removed the alleged "cloud" from this question at least. We are always ready to correct errors, when pointed out to us, but in this case it is evident that Mr. Merrill has entirely misunderstood the question and the mechanical principles involved, and we think that before writing a letter assuming such superior knowledge, and so much lacking in courtesy, he should at least have been sure of his ground. And possibly the apparent errors in our other answers, to which he alludes, exist, like this one, only in his imagination.]

The Solid Slotted Drill Rest.

Editor American Machinist:

There is no operation of the machine shop so simple or familiar that there is not a wrong way of doing it. Sadder than that is the fact that able, respected, successful mechanics will rise up and advocate the wrong in perfect sincerity. I am glad Mr. McConnell calls attention to the slotted drill rest again, because there is more that could, or perhaps that should, be said about it. I have seen the article used as Mr. McConnell shows it. Of course there is no difficulty in setting it so that some point of the slot will be the height of the center, but the least movement of the tool block outward or inward is equivalent to raising or lowering the slot in relation to the height of the center. It is necessary that the slot should be horizontal, or rather parallel to the cross slide of the rest. In lathes with a tilting carriage, like the Putnam, if the slot is set parallel to the cross slide, that is, level when the rest is at its lowest point, the slot will remain right at any elevation. In the tilting rest of a more antique type the cross slide remains horizontal, and if the slot be set horizantal at any elevation a change of elevation will also give it inclination, and then the least movement of the tool block in or out will change the relative height of the slot.

The slot should, as I say, be parallel to the cross slide of the rest, because to start the drill, the most convenient, and, in my opinion, the best and quickest way, is to draw the drill rest over to the front of the lathe, until the back edge of the drill touches the back end of the slot. The drill should in this way be drawn a little out of the center toward the front of the lathe until the front cutting edge cuts and trues the corner of the hole. Then, as the drill is carefully fed into the hole, the rest is eased off a little at a time, and finally the slot is moved inward or toward the back of the lathe until neither edge of the drill touches it.

This, I know, is better practice than the way very frequently adopted, of keeping the slotted rest fixed and central and holding the drill by a wrench, trusting to the friction of the drill in the slot to keep it rigid and central. Leaving the drill central in the slot, and holding it by the wrench so tight that it cannot slip in the slot, it can still spring a little, first to one side and then to the other, which is fatal to the absolute truth of the hole. Then, whatever slack or end play there may be in the screw and nut which move the tool block, varying as it does in different lathes from $\frac{1}{1000}''$ to $\frac{1}{4}''$, will contribute to the eccentricity of the hole.

When so slight a matter as this can allow of such discussion and honest difference of opinion and practice, the young mechanic may learn the necessity of constant thought in the machine shop, and how hopeless the position of one who would get along without it.

FRANK H. RICHARDS.

Rotary Cutters.

Editor American Machinist:

I noticed in your issue of Dec. 17, 1887, a paper read by Mr. John J. Grant before the American Society of Mechanical Engineers. I am glad to see Mr. Grant illuminating the subject of milling and milling machines, upon which undoubtedly many of our mechanics are still in the dark. After convincing a new purchaser of the superior advantages gained in the use of a milling machine it is frequently developed that there is an impression prevailing that milling cutters are much more expensive than lathe, planer and shaper tools. This is a mistaken idea. I have seen a cutter that had cut 30,000 teeth in cast-iron wheels of $\frac{3}{4}$-inch face and ten pitch, which was still in a condition to cut many more. The cutter had twelve teeth and certainly cost less than at least twelve planing tools necessary to do the same work, to say nothing at all about the increase of time it would have taken to use the planer or shaper.

I certainly do not mean to say that a spur wheel should ever be planed, but simply use the illustration because nearly every mechanic is more or less familiar with this kind of work, and it plainly illustrates the nature of the work of rotary cutters. It must be admitted that rotary tools cut faster, last longer and are therefore cheaper than planer tools.

FRED HOLZ,
Supt. Cincinnati Screw & Tap Co.

The Bursting Pressure of Steam Pipes.

Our readers will doubtless remember that we commented in a former issue on the explosion of a copper steam pipe on board the steamship Elbe, and the calculation of the pressure to which it was subjected, made by Mr. David Kirkaldy. Our correspondent, W. H. Booth, also referred to the matter in his article on the subject in our issue of December 17.

It now appears, from a letter written by Mr. Kirkaldy's son to *The Engineer*, that the calculation was made "simply for his own amusement," while on a train, and with no intention of mentioning it in his testimony. That he had not expected to testify upon that subject at all, but was forced by the court to submit his calculation, doing so under protest, and refusing to swear to it. While this, of course, does not prove that Mr. Kirkaldy made no mistake, yet it does show that he was most unfairly treated in the matter. No one is entirely free from mistakes, and it is certainly very unjust to compel any one to submit to court a calculation made under such circumstances, especially when he objects to so doing at the time. That part of Mr. Kirkaldy's testimony which he had been notified that he would be expected to testify upon is admitted to be correct, and it is manifestly unfair to go outside of that to criticise him.

About the usual number of communications are received so far this year, without signature. We suppose this is simply the result of carelessness, and have no doubt that those who send them wonder that they receive no attention. We ask, once again, that our correspondents will not neglect the important matter of their name and address, no matter what signature they wish appended to their communications. Letters not signed will receive no attention.

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Causes which Lead to Accidents, and which Draftsmen might Prevent.

The frequent occurrence of accidents on railroads, the fall of bridges, the collapse of a viaduct, etc., often accompanied by loss of life, of which we have heard so much lately, will naturally lead to inquiry as to the causes which bring about such catastrophes. It is safe to say that the causes of many accidents of this kind may be traced either to men not competent for the positions which they hold, and have secured through the desire of employers to obtain labor as cheaply as possible, instead of paying that to which skilled labor is justly entitled; or, it may be traced to gross carelessness. But sometimes we can trace the cause of an accident to a faulty construction, and it is this cause and its origin to which we wish to call attention.

When a machine is to be built, particularly when it is a complicated one, the first step to be taken is to draw out the design on paper, correctly proportion the different parts, and arrange them in a manner which will enable the mechanism to perform its functions, and work in harmony. Men engaged in this branch of the business are in some places called "mechanical engineers," but in many private establishments, where ability is considered to be of the first importance, and titles of little use, the mechanical engineers are simply called draftsmen. Therefore the duty of the draftsman is to bring out a design of a machine which will require the minimum amount of material, capable and strong enough to perform its work correctly, and resist all legitimate forces which may tend to destroy it. The construction of the machine should be such as will leave no fear or danger of its breaking down in any ordinary emergency. A machine that cannot meet these requirements indicates clearly that the draftsman who designed it did not understand his business or has been careless.

It seems to us that the employment of incompetent draftsmen can be avoided by proper care and vigilance on the part of the employer, and, providing he is not blinded by his ignorance or greed of gain, but can appreciate the services of a good draftsman, and is willing to give such remuneration as competent draftsmen, and in fact all skilled laborers have a just right to demand. Therefore it must be said that accidents, the cause of which can be traced to incompetent draftsmen or unskilled labor, are inexcusable.

First-class draftsmen will not take any needless risks in designing a machine; they will carefully calculate by established rules and be guided by well-known laws of the strength of material, so that their employers will not be subjected to financial loss caused by waste of material, or worse still, led to financial ruin caused by loss of life.

Any employer who believes that his draftsman—on whom he depends for correct construction and design of machinery—needs only a practical shop experience, and can guess at the correct strength and proportions of mechanism, either commits a great mistake, or admits his own ignorance. Of course, it is necessary that a draftsman should possess shop experience, but to be successful, he must have a thorough technical education; and whether this has been obtained in school or at home by his own perseverance makes no difference, so long as he has it, for, without it, particularly a knowledge of that branch which relates to the strength of material, the draftsman cannot do his duty to his employer or his fellow men.

Another cause which sometimes leads to faulty construction, is that mistakes are made by the draftsman, and in the majority of cases these mistakes have their origin in over-working the draftsman, or hurrying him from morning until night. The ability of the draftsman should not be judged by the number of yards—so to speak—of drawings made during the year, but should be judged by the successful working of the machines designed by him, and also by the financial standing and reputation of the firm gained thereby. The presence of the draftsman in the shop or office may be required from eight to nine hours per day, and a good conscientious draftsman will not object to these hours, when necessary, but to ask a draftsman to study and work steadily over a drawing board more than six hours day after day, is asking more than he can do without injury to his health, and such a request, in addition to a constant drive, may lead to mistakes which result in accidents and loss of life for which no one else but the proprietor or the company who engage the draftsman should be held responsible.

Mechanics for Mechanical Work.

We have often urged that, when the government carries on mechanical operations of any kind, it should see that mechanics are in charge of them, and that they should be appointed solely upon the ground of their practical knowledge of the operations which they are to superintend, and should be entirely removed from the influence of politicians.

A forcible illustration of this fact is furnished by recent occurrences in the Washington Navy Yard. A gun was ruined there, a short time ago, by the breaking of a boring bar in its muzzle, and now the breech block of a new 10-inch gun has been allowed to stick in its place, and, after some three weeks' work in attempting to remove it, it is found that the block, which cost about $1,000, must be bored out and a new one made. It is charged that two young naval officers, knowing nothing of mechanical matters, have, after two months' instruction, been put in as "inspectors of ordnance," and are now "strutting around, showing intelligent mechanics how to make guns."

We have not the least doubt as to the ability of our American mechanics and engineers to build a navy which will compare very favorably with any other in the world, but we do not believe it will be done in that way.

The U. S. Signal Service and the "Coast Survey" are almost entirely removed from political influence, not because the politicians wish them to be, but because men possessing the required degree of knowledge and ability to carry on the work of those departments must be kept in place, when once secured, or the work cannot be carried on; and the sooner the fact is recognized that the same plan must be adopted in the building of ships and guns, the sooner will the people of the country begin to get something like "value received" for the money which they pay for such purposes.

Manual Training in Public Schools.

It is amusing to note the way in which the average newspaper writer treats the subject of manual training, now coming into vogue in common schools. It is, in all gravity, assumed that this training is to bring out, so to speak, a nation of trained workmen—the result of which is, of course, to make the wages of skilled mechanics materially less than that of ordinary laborers. It would be, apparently, as easy to change the laws of nature as to convince these writers, and a good many of their readers, that mechanics will never be made in public schools, any more than doctors or lawyers will be made there. They will go on for some years yet, writing and believing that a little book-learning in the right direction, and an opportunity to cut up timber, mutilate metal, and mould clay, is all that is needed to make a mechanic of a boy who attends, by compulsion or otherwise, our excellent public schools for three or four years. Eventually, when it is observed that the supply of skilled mechanics is no more in excess than before the era of public school manual training, they will tax their energies to invent reasons for the anomaly.

We are not questioning the policy of manual training in public schools. It is a question upon which opinion and argument are fairly divided, and one that will be settled only by trial. But the claims that are made for it by many well-meaning enthusiasts, and that are frequently admitted by those who think it will work harm, are manifestly absurd and likely to work injury.

The Fireman not Likely to Go.

A recent occurrence on the Erie Railroad may help to convince some of the newspaper men, who write upon mechanical matters, that they are extremely liable to err when writing about matters which they know little or nothing about.

Some of them have mentioned among the advantages to be gained by the use of petroleum in locomotives, the dispensing with the fireman—a statement which is, of course, the result of an utter lack of knowledge of railroading.

The accident alluded to above occurred January 12th.

The engineer, William W. Payne, leaned out of the cab window, and, his head coming in contact with some object, he was instantly killed, and fell at the feet of the fireman, who took charge of the engine and brought the train in safety to the next station.

If no fireman had been on the locomotive at the time, the train with its passengers would have gone on with all the chances in favor of an accident of the most serious character.

There are many good reasons which might be stated, for the employment of three men on every locomotive, but there are no good reasons for dispensing with the services of one of the two now employed.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(43) J. H. E., Woburn, Mass.: We will answer your question by an article on the subject.

(44) E. M. W., Fairfield, Conn., asks: Will you give me a simple formula for calculating the diameters of steps on cone pulleys to keep an even tension on the belt? *A.*—You will find rules given in the AMERICAN MACHINIST, Oct. 15, p. 1; Oct 22, p. 2; and Nov. 26, p. 2, 1881.

(45) J. K., Conshohocken, Pa., asks: Which is the best fuel to use in a common cupola for melting iron to make strong, heavy castings? *A.*—We think you will get about equal results with coke and coal. Some foundrymen think coke is better when superior castings are required; others think coal equally good.

(46) S. Chattanooga, Tenn., asks: How is lard oil extracted from lard? How is acid extracted from tallow when cylinder oil is wanted? *A.*—We have had no experience in the manufacture of oils, and since the persons engaged in this business do not care to give the methods asked for, we cannot give the information.

(47) J. N. B., Brantford, Ont., asks: What size should a boiler (low type) be for a portable engine with cylinder 9 inch diameter, 4 inch stroke, making 200 revolutions per minute. What heating surface should it contain? *A.*—The boiler should have 320 square feet of heating surface and about 10 square feet of grate surface.

(48) Subscriber, Providence, R. I., writes: What working tension should be allowed on a leather belt per inch in width? I have a book which says 45 pounds per inch; is that correct? *A.*—45 pounds per inch in width of belt is assumed to be good practice. 2. All your other questions have been answered in Question 38, January 28, 1888.

(49) F. L. L., Manchester, N. H., asks: 1. Will you please inform me whether it is possible to cut a thread of correct pitch on a tapering piece in the lathe, with the use of the taper attachment, the centers being set as for straight work? *A.*—Yes. 2. Will you tell me also how the tool should be set? *A.*—The center line of the tool should be at right angles to the center line of the work.

(50) C. V. K., Syracuse, N. Y., sends us four questions whose answers will require too much room in the Q & A. columns. The subject to which these questions refer will very soon be thoroughly explained in the articles on Practical Drawing, now appearing in the AMERICAN MACHINIST. 2. Give me the name of any book which will answer the questions. *A.*—Any good descriptive geometry.

(51) G. P., Wheeling, W. Va., asks: Is it possible to case-harden cast-iron? *A.*—Not that we are aware of. Some time since a correspondent of the AMERICAN MACHINIST contributed the following, which he said he used for chilling or hardening cast-iron: soft water, 10 gallons; salt, one peck; oil vitriol, one pint; saltpetre, ½ pound; prussiate of potash, ¼ pound; cyanide of potash, ½ pound. Heat the iron a cherry red and dip as usual. If wanted harder, repeat the process.

(52) S. D. A., Brooklyn, N. Y., writes: 1. Will you please give me the date of paper containing the directions for lacing rubber belts? *A.*—AMERICAN MACHINIST, July 2, p. 2, 1887. 2. Also date of paper containing a receipt for producing a smooth surface on rubber belts? *A.*—July 2, p. 2-3. Does boiled linseed oil used to prevent rubber belts from slipping, injure the belt in any manner? *A.*—We believe not; it has been recommended for the purpose of preventing the belt from slipping.

(53) C. S., Cincinnati, Ohio, asks. 1. Will you please tell me when a boiler is foaming, and how to stop it? *A.*—You can tell the foaming of a boiler by the occasional fluctuation of the water in the water glass gauge. The foaming can be stopped by cleaning the boiler. 2. How are inclines figured—say I have a grip with inclined slot, how do you find the pressure on the cable? *A.*—Send more particulars, and we will tell you. Our paper, so far, does not contain a complete presentation of the subject which you name, but we expect to take it up soon.

(54) J. S., New York, asks: What is best to do with a smoke stack which is exposed, in cold weather? It condenses the vapor inside it very much. Some of the laps and seams open, the drips blow off with the wind, causing annoyance to our neighbors. We wish to remedy it if possible. Stack seems to be sound; it is 18 inches in diameter, 70 feet high, iron about 3-16 thick. We paint once a year with paraffine; stack in use 42 months. *A.*—Stacks of this kind will always give more or less trouble such as you speak of. We know of one way only to prevent the condensation, and that is, the use of a double stack, leaving a space of about 1 inch between the two.

(55) T. G. L., Dunkirk, N. Y., asks: 1. Can you give me a simple rule for finding the mean effective pressure of steam in the cylinder of an engine at various points of cut-off? *A.*—To do this you will require a table of hyperbolic logarithms. This you will find in works on the steam engine indicator, or in most works on steam engineering, with full instructions for finding the mean effective pressure by its use. 2. What is the meaning of the word Tangye, as used by the Buckeye Engine Company? *A.*—Tangye is the name of an individual, and his name is sometimes applied to certain bed plates of machinery, much as the name of Corliss is applied to a certain type of steam engine.

(56) E. K., Newark, N. J., writes: I have been a constant reader of your paper for more than eight years, and have seen that you condemn certain practices, one of which I would like some advice on, and I think a number of your readers have an interest in it. In July '86 I subscribed for —— through a dealer for one year, and paid for it, requesting that it be stopped at the end of the year. A notice was sent me at the end of the year that my subscription had expired. During the year I had changed my residence, and instead of sending the paper to the dealer, they kept sending it to me direct and have kept on sending it, although I have refused to receive them. Now they have sent me a bill for one year's subscription; this bill I returned and they sent it to me again. I want to know what to do under the circumstances, and if they can collect anything? *A.*—Under the circumstances, as you state them, the publishers of the paper named cannot collect anything from you. If you had continued to receive the paper there is a possibility that they might collect, although you had ordered its discontinuance. We do not say this is so, but it is sometimes so claimed. But if the publisher of a paper continues to send his paper to you against your orders, and you refuse to accept it, he has no legal account against you. Under the circumstances named we should refuse to pay the bill, and we should also have a very poor opinion of the publisher who wanted to force the acceptance of his paper where it was not wanted.

(57) C. M., Syracuse, N. Y., writes: 1. We are building a steam engine for ourselves, which will be a high pressure condensing engine. Surface condenser used. Steam ports, 1¼ inch x 6 inches, exhaust port, 1 9-16 inch x 6 inches; width of bridges, 1 1-16 inch; throw of eccentric, 2¾ inches; diameter of cylinder, 15 15-16 inches; stroke, 16 inches; engine to make 91 revolutions, and the boiler pressure 75 pounds. What I want to know is, what will be the dimensions of the valve to cut off steam at half stroke? *A.*—If the throw of the eccentric is 2¾ inches, that is, twice its eccentricity, and no rocker with unequal lengths of arms used, then the travel of the valve will be 2¾ inches. Under these conditions the valve will need 31-32 inch lap (nearly), to cut off at half stroke, and the greatest width of steam port opening will be 13-32 inch. If you mean by "throw" the eccentricity, then the travel of valve will be 5½ inches. Under these conditions you will need 1 15-16 inch lap to cut off at half stroke, the greatest width of steam port will be 13-16 inch, and exhaust port will be pretty well choked up. It seems to us that the ports are not suitable for cutting off at half stroke; in fact, in engines of this size we would prefer to use a separate valve for cutting off so early. The area of the ports is also somewhat small for the speed of engine. 2. Just give me a kind of an idea of how to lay out a valve to cut off at half stroke. *A.*—You will find this explained in the AMERICAN MACHINIST, Nov. 21, p. 6, 1885. 3. What horse-power do you think the engine will be? *A.*—With correctly designed ports, and cutting off at half stroke, you will obtain about 100 horse-power; in this answer we have made no allowance for the friction, and the power necessary to drive the engine.

(58) T. P., —— We are about to build a side-wheel steam yacht to run in shallow water. It will measure 36 feet in length, 8 feet beam, and draw 1 foot. The owner wishes to run it himself, and not being an engineer wishes to use some power other than steam. Would it be possible to use a hot air engine in such a boat? Or do you know of any one using or making a hot air engine for such a purpose? Would we get power enough to run such a boat from hot air? If hot air is not suitable for such a boat, could you advise us as to any other motor which would be easy to manage and not liable to give trouble to an amateur. What horse-power would it require to drive such a boat 8 miles an hour in smooth water? *A.*—We do not consider a hot air engine suitable for your purpose; although the boat can be run with such an engine, it seems to us that speed of the boat would not be satisfactory. We have not heard of hot air engines being used for this purpose. Petroleum, and sometimes naphtha engines are used. But in our opinion there is nothing safer, or more suitable for your purpose, than a simple steam engine, and a strong and correctly constructed boiler. It is difficult for us to tell the horse-power required, without knowing more of the details, but we should roughly estimate that it will require 10 horse-power to run the boat at a speed of 8 miles an hour.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Gear Wheels. See Adv., page 16.

Link-Belting.

Send for catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Lamb Knitting Machine Co., Chicopee Falls, Mass.

Machine work and patternmaking. Anderson Machine Works, Peekskill, N. Y.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

For Electric Recording Steam Gauge, write Telemeter Co., 44 Barclay st., New York.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Drop presses, punches and shears. Williams White & Co., Moline, Ill., manufacturers.

For catalogue of 2d hand lathes, planers, etc., write to John Steptoe & Co., Cincinnati, O.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

For first-class automatic engines write to Williams Engine Co., 447 North street, Baltimore, Md.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 120 Liberty st., N. Y.

Ice and Refrigerating Machines, 124 built, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N.Y.

Burnham's New Improved Turbine; sold at cost of manufacturing and advertising. Address York, Pa.

Pattern Letters and Figures to place on patterns for castings. H. W. Knight & Son, Seneca Falls, N. Y.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Machinery list free: lathes, drill presses, engines, other machinery bargains. C. L. Jackson & Co., Baltimore, Md.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Berryman Patent Feed Water Heater and Purifier, and the Economic Boiler Feed Pump. Benj. F. Kelley, 91 Liberty st., New York.

Nicholson & Waterman, Providence, R. I., one 46 in. horizontal boring mill; 5 in. cutting-off machines; 14, 16, and 30 in. engine lathes.

The Dexter Machine Co., Dexter, Maine, are building a fine grade of engine lathes and upright drills which they sell at a reasonable price.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Quints' Pat. Auto. Steam Engine Governor. Correspondence solicited from mfrs. of Throttle Gov'nr Engines. Leonard & McCoy, 118 Liberty st., N. Y.

The Brown & Sharpe Mfg. Co. have placed at No. 23 S. Canal st., Chicago, Ill., a sample line of milling machines and other machinery with S. A. Smith.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Jan. 14, p 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet, illustrating pumping machinery and reports of duty trials.

W. H. Hoffman, consulting engineer, 94 Liberty st., N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.

New book on gears; Tables giving 3,094 diameters, with rules for calculation of movements of shafts, etc.; sent on receipt of P. O. Note; price, 50 cts. Address C. B. Long, M. E., Worcester, Mass.

A. K. Mansfield & Co., mechanical engineers and experts in machinery patents; 18 years' experience; convincing references; practical working drawings, estimates, supervision. Room 256, 280 B'way, N. Y.

Hot Water Supply. A practical treatise on the fitting of hot-water apparatus for domestic and general purposes. By F. Dye. 82 pages, with 25 illustrations. 12mo., cloth, $1. Send for catalogue. E. & F. N. Spon, 35 Murray st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

Fraser & Archer, general machinery dealers, have an excellent assortment of 20, 25, 26, 28, 36 and 38 inch upright drills in stock, which they are offering at extremely reasonable prices. It will pay any one in need of drills to communicate with them before making their purchases elsewhere. Any one interested in iron and wood machine tools would be repaid by a visit to inspect the complete line at their warerooms, No. 121 Chambers st., N. Y.

The series of articles by J. G. A. Meyer, on "Practical Drawing," now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October, 23, 1886 issue, and up to and including January 14, 1888 issue, 41 articles have been so far published. Copies containing these articles, sent by mail to any part of this country or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton street, New York.

"Modern Locomotive Construction," by J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 56 articles have thus far appeared up to and including the January 21, 1888 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton street, New York.

MANUFACTURES

Baldwin & Early will build a lath mill at Coosa, Ga.

L. H. Taylor will build a grist mill at Gabbettsville, Ga.

It appears to be definitely settled that a watch factory will soon be in operation at Wichita, Kan.

The Hill Clutch Works, Cleveland, Ohio, have opened an office at 28 South Canal street, Chicago, Ill.

The Manly Manufacturing Company, Dalton, Ga., are building works to manufacture bridge work, fencing, etc.

J. W. Dennis & Co., Buffalo, N. Y. send us a card circular of their single cord belt shifter. A cut shows the construction.

Thomas T. Wood & Co. is the name of a new firm that will build Wood's traction engines, as well as hoisting engines, at St. Louis, Mo.

The Flexible Wire Mat Company, a new concern in Cincinnati, O., is building shops in which machinery will be placed for making wire mats.

The Syracuse Tube Company, Syracuse, N. Y., send us a new price list of wrought-iron and galvanized pipe, which supersedes all previous lists.

Jones & Rogers, Cincinnati, Ohio, have issued a circular of their cut-off couplings, friction pulleys and pulley sleeves; also a price-list of pulleys. Cuts and description show the construction.

The Atlas Iron and Brass Works, successors to the business of Lind & Carlson, at Kaukauna, Wis., are enlarging their works, and will build paper mill machinery and do a general machine shop and foundry business.

Water-works or enlargements are talked of in the following places: Welland, Can.; Rantoul, Ill.; Herkimer, N. Y.; Mt. Sterling, Ky.; Lebanon, Pa.; Hendersonville, S. C.; Seabright, N. J.; Americus, Ga.; Warrenton, Va.; Lindsburg, Kan.

The Castle Engine Works, Indianapolis, Ind., write us: Business is very good with us. We have just received the fifth order from one concern and the third from another. The outlook is in every way decidedly better than it was one year ago.

The Martin Anti-Fire Car Heater Company, Dunkirk, N. Y., send us a catalogue descriptive of their system of car heating. The catalogue is a model in its way, both typographically and artistically. No expense has been spared in the matter of engravings, which are models of the engravers' art. The catalogue is profusely illustrated, and printed on a superior quality of paper.

The Japanese of it is to paint steam engines yellow. The Straight Line Engine Company, of Syracuse, N. Y., have just shipped three engines 9 by 12 inches of 36 horse-power to Japan. Prof. Sweet says these three make up a dozen shipped by them to that country.

Pedrick & Ayer, Philadelphia, Pa., write us: We are now boring out in their present positions two blowing cylinders, 46" x 36", for the Bellaire Nail Works, at Bellaire, O., and are facing off 12 valve seats with our portable plane for the Riverside Iron Works, at Wheeling, W. Va.

The Gage Machine Works, builders of machine tools, Waterford, N. Y., write us: Business for the past year was very good. We sold a good many tools, mostly for brass finishing, and at fair prices, and while there is not much call for tools at the present time, are anticipating a good trade this year.

The Bradley Company, Syracuse, N. Y., write us: We have had a prosperous year for 1887, running about 300 men at full time during the year. The prospects for 1888 are equally as good, as we have a large accumulation of orders both for home and foreign account. We judge other manufacturers must be equally as fortunate, as our hammer sales have increased very largely during the past year.

The Page Belting Company, Concord, N. H., are meeting with good success in the introduction of their wire-sewed leather belting, for special purposes. These belts are sewed with special copper pointed wire, which is clinched. The work of sewing is done by a machine made for the purpose. In belts thus fastened the wire is, so to speak, drawn into the leather, so that only a leather surface comes in contact with the pulley.

Chas. A. Strelinger, manufacturer of wood and metal-working tools, Detroit, Mich., writes us: Our last year's business was eminently satisfactory, the increase over the former year's business being fully up to and beyond our expectations. Thousands of our catalogues are in the hands of mechanics all over the country, and there is scarcely a week passes that we do not receive orders from nearly every State and Territory in the Union. We have every reason to hope for a largely increased trade during the coming year.

The Missouri Car and Foundry Company, St. Louis, Mo., did $2,750,000 worth of business during 1887, and at the present time are working to their full capacity—twenty finished cars per day. The contracts they have in process of execution call for 1,000 cars, distributed in part as follows: 400 box and 400 stock cars for the Atchison, Topeka & Santa Fe; 200 coal cars for the Pennsylvania; 50 coal cars for the Kansas City and Southern; 150 coal cars for the Missouri Pacific; nine caboose cars for the Kansas City, Ft. Scott & Gulf. The freight car demand promises to be as good with them as during 1887.—*The Age of Steel.*

As soon as the winter begins to open up the improvements at the Panhandle shops here will be begun. It has been decided to erect a number of new buildings. A foundry completely equipped will be built at a cost of $36,000. In addition to this a pattern, storeroom and cleaning, and grinding departments will be erected, the former at a cost of $5,400, and the latter at a cost of $2,000. A 120-feet extension to the blacksmith shop will be made, at an estimated cost of $9,000. A dry-kiln to cost $7,000 will also be built. Tools to the value of $30,000 will be added to the equipment of the different departments. The work is progressing favorably at the beginning of the new year, and Master Mechanic Reynolds, Logansport, Ind., will no doubt carry out the programme of the year well.—*Ohio State Journal.*

The Denver (Colorado) *Exchange Journal*, says: We have several very extensive shops here now. They are, however unable to supply the demands. We know from actual observation that persons have been from one foundry and machine shop to another throughout the city trying to get work done, and that they have been refused altogether, or else told that they must wait their turn, or else the price quoted would be so manifestly extortionate that it would be madness to leave the work, and we know of several small factories that would have started here during the past summer if they could have had reasonable machine and foundry work done for them—they being of too small consequence to afford foundry and machine shop with each enterprise, capital also being limited.

Sales of the Babcock & Wilcox boiler for December are as follows: Solvay Process Co., Syracuse, N. Y., 5th order, 108 horse-power; Wm. Weightman, Philadelphia, 2d order, 330 horse-power; C. B. Grubb & Son, Lancaster (Henry Clay Furnace), 240 horse-power; J. & G. Fowler, N. Y., for Cuba, 2d order, 146 horse-power; Alex. Smith & Sons' Carpet Co., Yonkers, 5th order, 200 horse-power; Glass-Edsell Paper Co., Delaware, Ohio, 2d order, 136 horse-power; Girard Estate, Philadelphia, 3d order, 415 horse-power; Midvale Steel Co., Nicetown, Philadelphia, Pa., 272 horse-power; Sone & Fleming Manufacturing Co., Ld., New York, 2d order, 208 horse-power; Geo. Bruce's Son & Co., New York, for Mexico, 2d order, 92 horse-power; South Bend Toy Manufacturing Co., So. Bend, Ind., 2d order, 136 horse-power; James Simpson & Co., London, England, 108 horse-power; Walker Bros., London, Eng., for Ceylon, 6th order, 15 horse-power; Langworthy Bros., Salford, England, 173 horse-power; Ing'o San Lino, Cienfuegos, Cuba, 292 horse-power; J. Simpson & Co., London, England, for Bournemouth Gas and Water Co., 109 horse-power; Imperial Continental Gas Association, London, for Vienna Theater, 744 horse-power. Making a total of 3,724 horse-power.

Machinists' Supplies and Iron.

NEW YORK, Jan. 19, 1888.

Iron—American Pig—The struggle now going on in Eastern Pennsylvania is having considerable effect upon the condition of the iron market. The furnaces that are yet in blast are using a mixture of coke and anthracite, no one can tell when operations may have to cease entirely, and the outlook is considered to threaten further complications and embarrassments. We quote Standard Lehigh brands $21 to $21.50 for No. 1 X Foundry, but outside brands can be obtained at $20 to $20.50. Grey Forge ranges from $16 to $17.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Men to sell planes, see page 11.

A mech'l draftsman and designer has had, practical shop exp., wants position. H. E., AM. MACHINIST.

Experienced machinist in building marine and stationary engines; capable of handling men, wants position. B. J., AM. MACHINIST.

Wanted—Position as master mechanic, by an A1 man, on a railroad having facilities for doing their own work. M., AM. MACHINIST.

Wanted—A position by a successful foreman patternmaker on locomotive or machine work. Foreman Patternmaker, care AM. MACHINIST.

Machine shop foreman; experienced on stationary and marine engines and machinery, wants engagement. Address F. M., AM. MACHINIST.

First rate mechanic, gunsmith, designer of machinery and tools; first-class experimenter, is open to engagement anywhere. Expert, AM. MACHINIST.

Situation wanted by a competent draftsman with technical education; 7 years' practical exp.; French and German lang. R. M., 351 E. 14th st., N. Y. City.

Wanted—Situation as superintendent or assistant of machine works; building engines preferred; designer and draftsman; understands indicator. H., AM. MACHINIST.

Foreman wanted who can manage about twenty-five machinists and get out engine work at lowest cost of good work. Address J. S. & Co., Lock Box 25, Manchester, N. H.

Wanted—Foreman in foundry department of stove works; must be a first-class practical stove plate moulder in the New England system. Rathbone, Sard & Co., Albany, N. Y.

Engine salesman wanted; one acquainted with the trade in New York, Philadelphia, and vicinity; to sell improved engines. Address D. R. R. & Co., care J. A. Emerick & Co., Philadelphia, Pa.

Wanted—A good machinist with push and executive ability; capable of handling about 30 men in general machine shop; no hurry; give age, experience and references. D., AM. MACHINIST.

Wanted—A capable draftsman; must be a practical machinist or pattern maker, and understand automatic cut-off. Address with references, and state wages expected, J. M. K., AM. MACHINIST.

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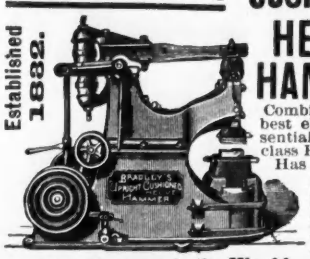

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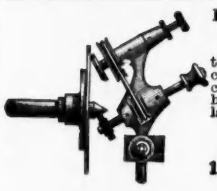

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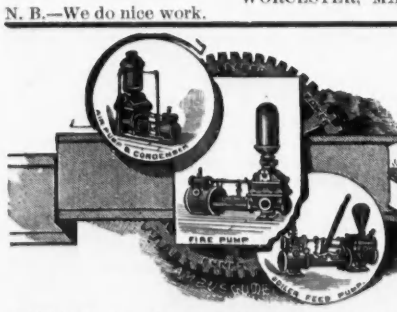

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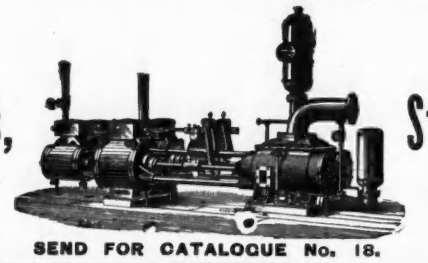

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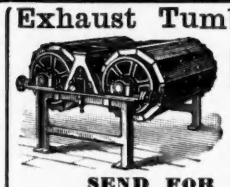

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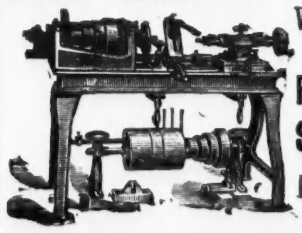

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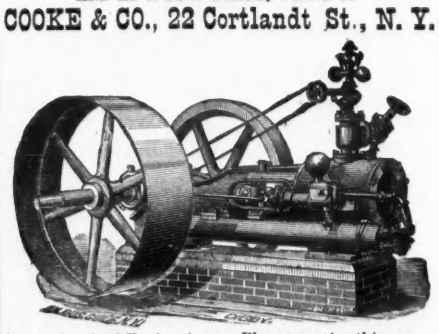

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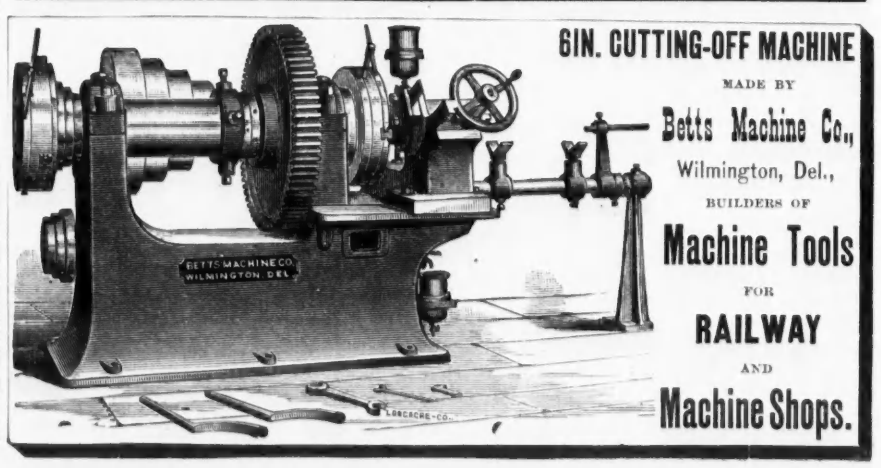

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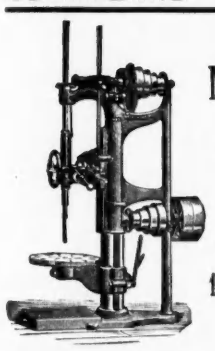

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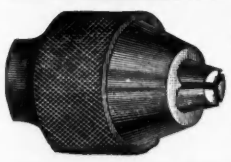

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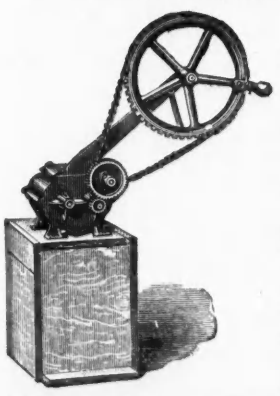

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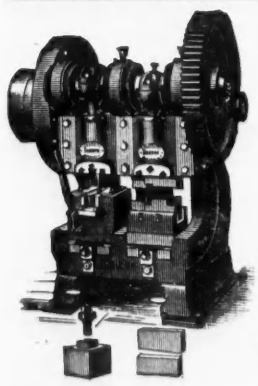

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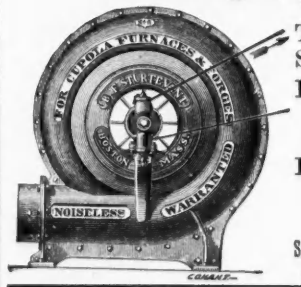

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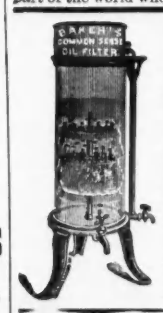

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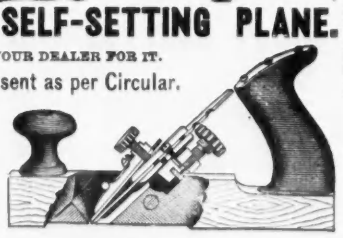

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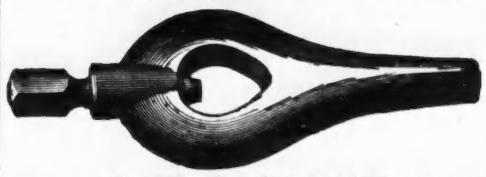

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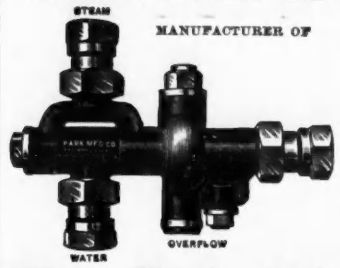

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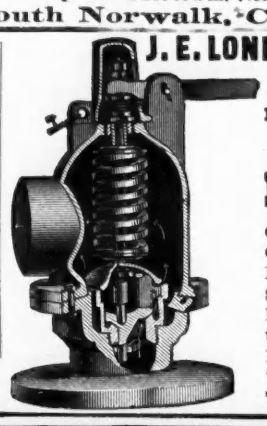

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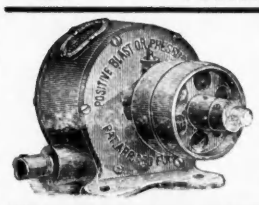

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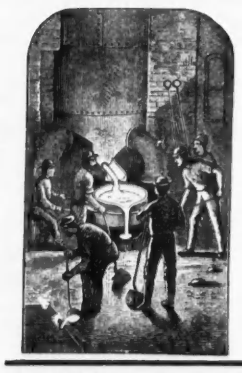

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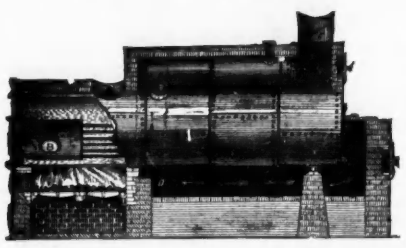

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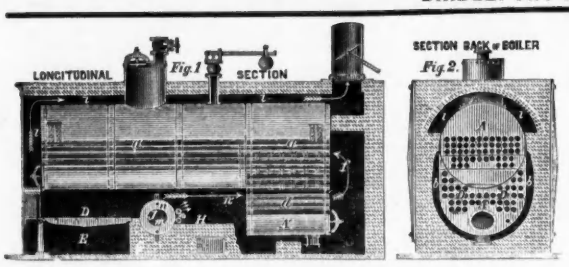

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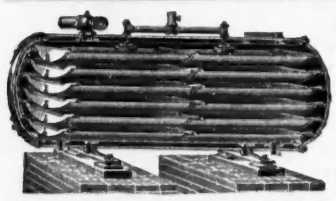

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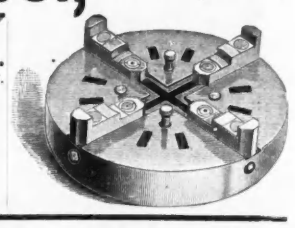

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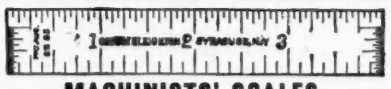

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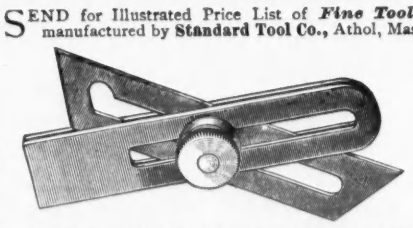

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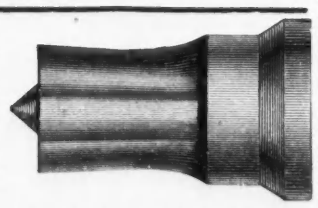

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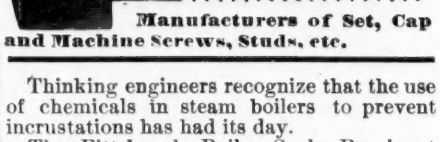

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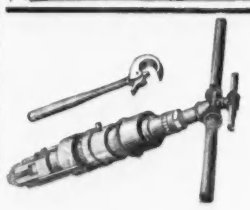

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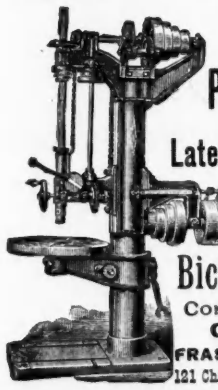

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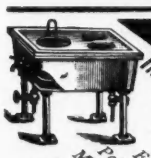

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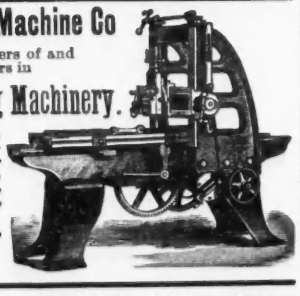

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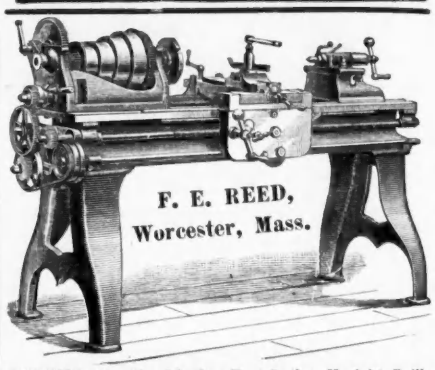

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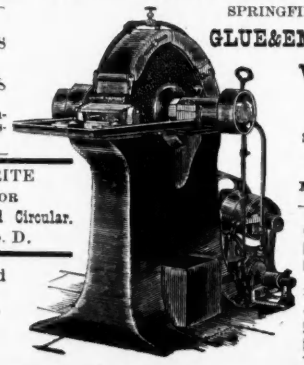

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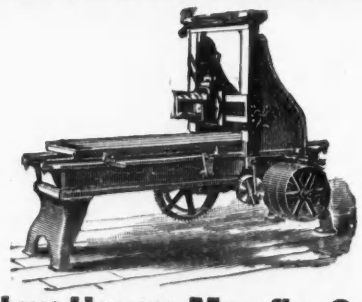

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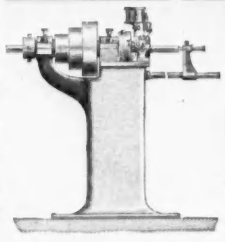

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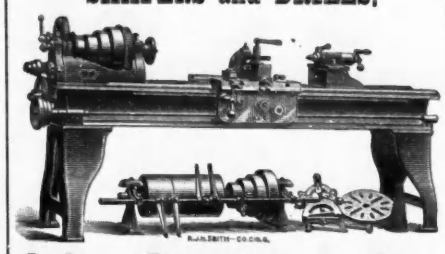

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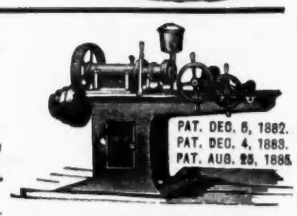

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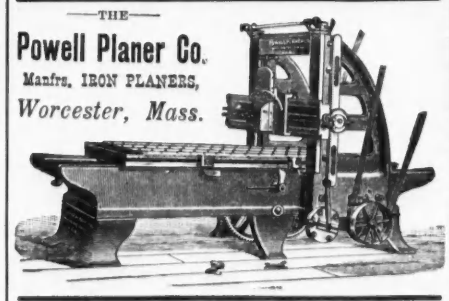

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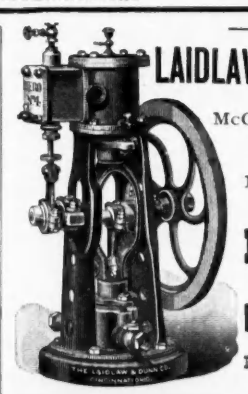

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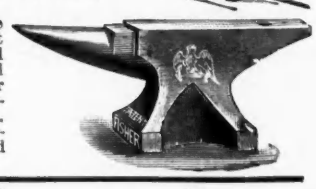

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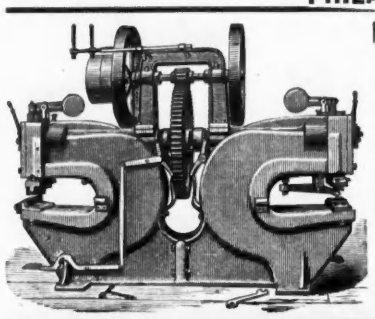

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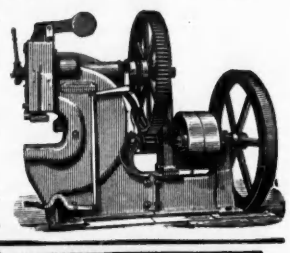

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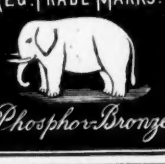

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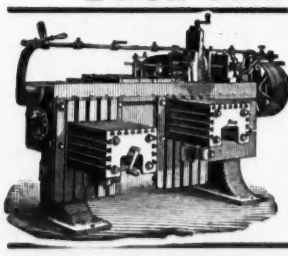

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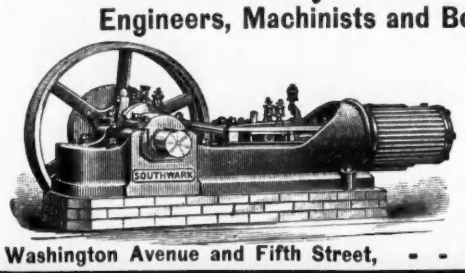

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Gentlemen:—We take pleasure in recommending your Open Side Planer to any one wanting a strong efficient planer.
Truly yours,
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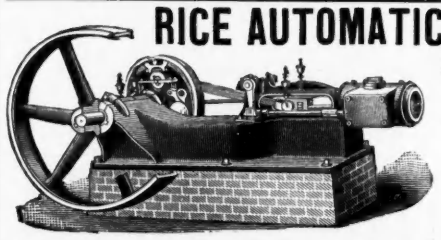

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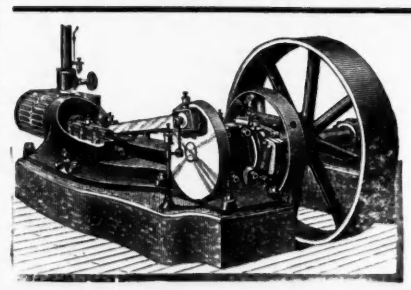

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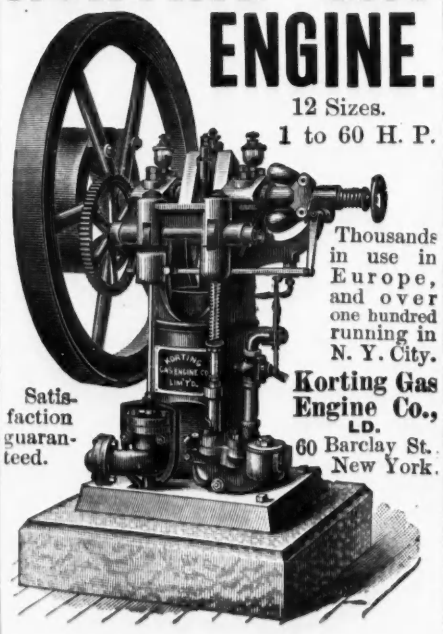

Thousands in use in Europe, and over one hundred running in N. Y. City.

Satisfaction guaranteed.

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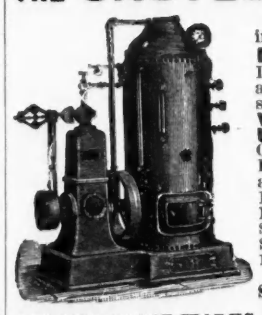

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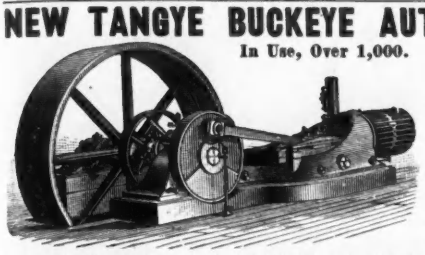

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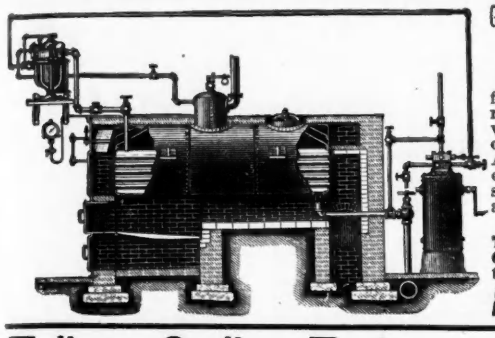

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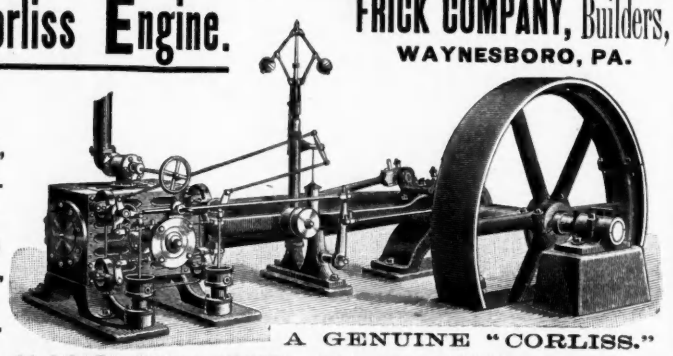

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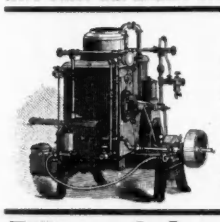

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16-20 in. x 10 ft.	"	Bridgeport,	good as new.
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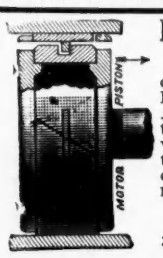

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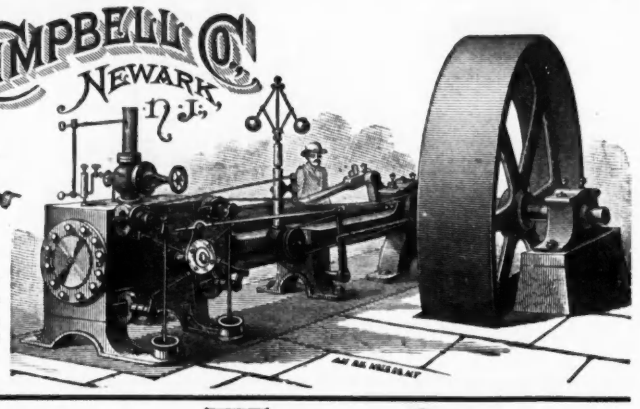

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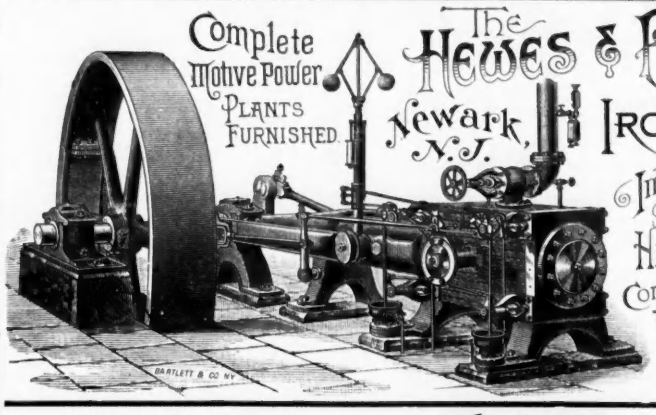

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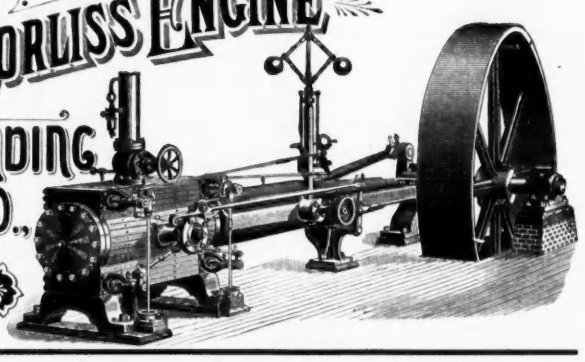

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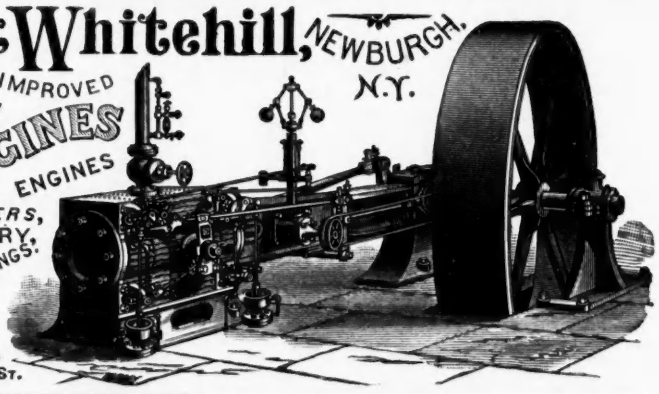

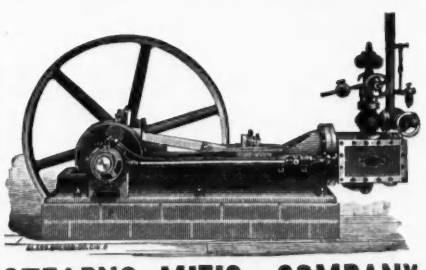

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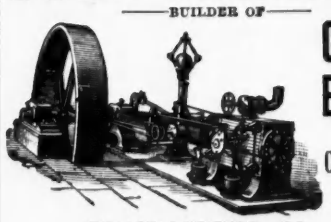

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NO DANGER.

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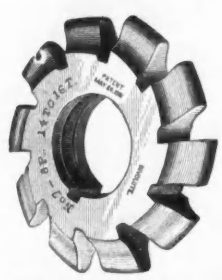

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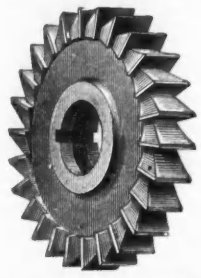
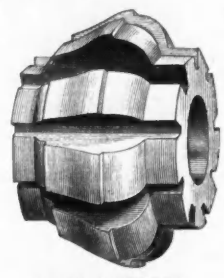


SIDE MILLING CUTTER.



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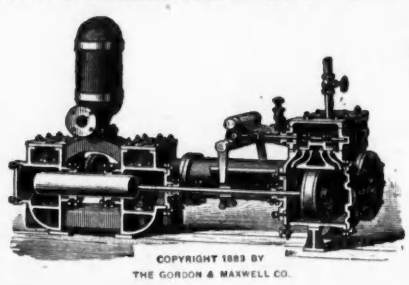
Coincident with the rapid and wide extension of the use of Milling Machines, has come an increased demand for Milling Cutters. Without good cutters, the efficiency of Milling Machines is much abridged.

In extending the product of its Milling Department, the BROWN & SHARPE M'f'g Co. has made many new varieties of Milling Cutters, and in order to supply the wants of customers, has found it necessary to greatly increase the number carried in stock. The INVOLUTE GEAR CUTTERS in stock are from 3 to 48 pitch, 8 cutters to each pitch. The Epicycloidal are from 2 to 10 pitch, 24 to each pitch. The curves of gear cutters are obtained by machinery. SIDE MILLING CUTTERS, from 3 1-2 in. to 8 in. diameter, are carried in stock. On work having parallel surfaces, these cutters may be used in pairs FORMED CUTTERS, for cutting various outlines, are made to order. These, as also the Gear Cutters, can be sharpened without changing their original form—a feature appreciated by those producing work in duplicate. By making cutters in large numbers, with expensive special tools, much greater accuracy has been attained than can be reached by the usual methods of manufacture. Users of cutters will generally find it more economical and satisfactory to purchase from experienced makers, rather than to attempt to manufacture for themselves. Catalogues mailed on application. All kinds of cutters made to order.



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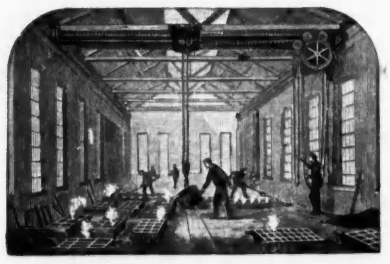

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—FOR FOUNDRY USE.—

Particulars on application. Full Specifications and Tender promptly submitted on receipt of capacity and span of bridge desired.

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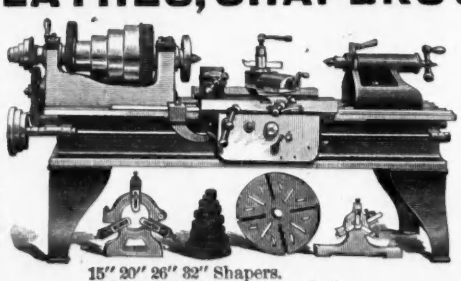

15″ 20″ 26″ 32″ Shapers.
17″ 19″ 21″ 24″ 27″ Engine Lathes.
20″ 24″ Upright Drills.
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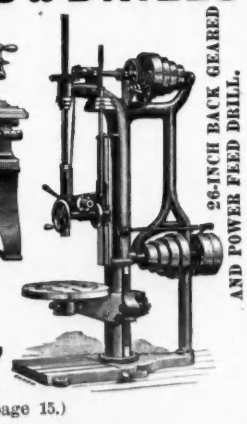

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Send For Prices. It Will Pay You.

(See "Important" Notice of Engine Lathes on page 15.)

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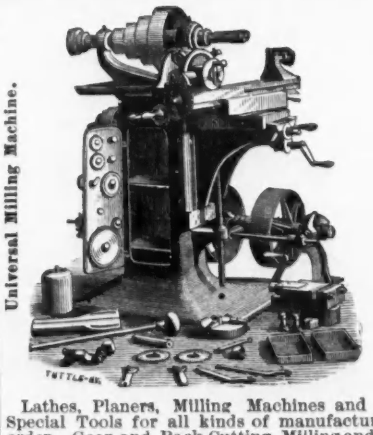

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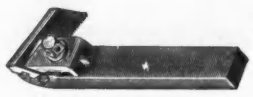

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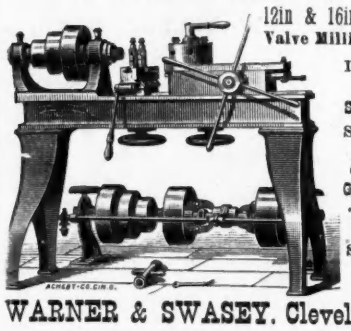

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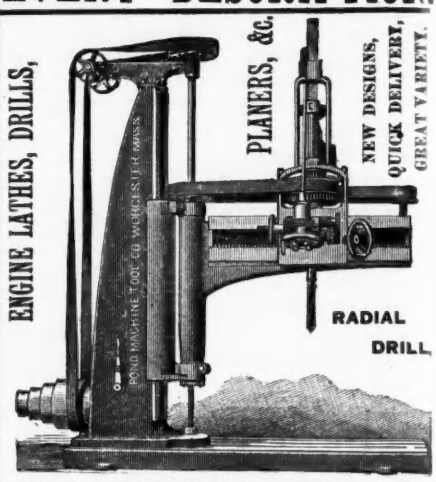

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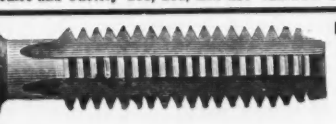

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